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EXAMINER	
SOUW, BERNARD E	

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2881	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/786,507	Applicant(s) ARDAVAN ET AL.	
	Examiner Bernard E Souw	Art Unit 2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 May 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *21-32,36-44 and 50-80* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *21-32,36-44 and 50-80* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 March 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *05/17/2004*.
4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. *041404*.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Amendment

1. The Amendment filed 05/17/2004 in response to the office action mailed 12/15/2003 has been entered.

Claims 29, 33-35 and 45-49 have been cancelled.

Claims 1-20 have been previously cancelled.

New claims 50-80 have been added.

The present office action is made with all the amendments being fully considered.

04/94/2004 Personal Interview

2. A personal Interview has been held on April 14, 2004, with both applicants and their attorney present. The Interview Summary filed with applicant's 05/17/2004 Response is acknowledged. In consideration of the new evidences brought up during the interview, all previous objections to the disclosure and all claim rejections based on 35 U.S.C. §101 and §112/¶.1 have been provisionally withdrawn, pending review of Applicant's response which includes a Declaration and the experimental data presented during and after the interview. Such a review has been made.

Supporting Data

3. In addition to applicant's arguments and an affidavit under 37 CFR 1.132 written by a third party (D. Rickel), four supporting documents have been received, i.e., a summary of experiment conducted to support the present application, including data of

the experimental results, titled "*Description of an Experiment*", hereinafter denoted as Exhibit A; two copies of applicant's recent publications in J. Opt. Soc. Am. A20 (11), 2003 and J. Opt. Soc. Am. A21 (5), 2004, hereinafter denoted as Exhibit B and Exhibit C, respectively; and a provisional paper by Ardavan et al. titled "*Experimental demonstration of a new radiation mechanism*", hereinafter denoted as Exhibit D. This office action is made with all the supporting documents being considered (see "*Evaluation of Applicant's Experimental Data*" towards the end of this office action).

Repeat of Previous Objection

4. Since in reality there is no "*superluminal velocity*" whatsoever, but only "*phase delay*", as generally known and used in the pertinent art (see later sections), and furthermore, because the word "*superluminal velocity*" could be --and has been-- easily misinterpreted and/or manipulated, it would be better in regard of the imposed rejections under §101 and §112/¶.1 to eliminate every word "*superluminal*", including all related wording, from the entire disclosure, including the claims, in order to conform with the reality.

This objection is a repeat of the prior Office action.

Claim Objections

5. Claim 32 is objected to under 37 CFR 1.75(c), as being of improper dependent form for being dependent on claim 29 that has been a canceled. Applicant is suggested

to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

To proceed with this office action, claim 32 could be assumed as being dependent on claim 28, in which case the claim becomes identical to claim 31. Therefore, claims 31 and 32 are examined together, as if they are one claim.

Withdrawal and Reinstatement of Previous Objections

Objection to the Specification

6. The wording *"intensities of normal emissions decay at a rate of R^{-2},* specifically regarding the words *"emission", "decay",* and *"rate",* having been adequately explained, the previous objection is now withdrawn.

7. The disclosure stands objected to because of the following inconsistencies effectively leading to an *incredibility* of the invention, as already stated in the previous office action, now reinforced by the analysis and new findings presented in this office action.

(a) On page 4, lines 4-5, the wording *"the superluminally rotating* **source** *from the standpoint of geometrical optics"* is in direct violation of known laws of nature, i.e., the Special Theory of Relativity, which prevents any *material object* --such as a "source"-- from moving with luminal (let alone superluminal) speed in vacuum, since its mass would then become infinite, and the causality principle violated, the latter even without regard of the mass, as generally understood in the art.

This objection remains essentially the same as previously applied, since applicant's response & arguments, supported by factual evidence including the affidavit submitted with the amendment, have failed to persuasively remove the prevailing objection. This conclusion is supported by the general opinion from scientific community on applicant's invention, as recited in [PhysicsWeb'2004]) at <http://physicsweb.org/article/news/8/7/161>, stating that the inventors "...*have got their physics wrong*". As such, it provides a basis for the §101 rejections made in this office action (MPEP §2107.01/II; see later).

(b) On page 6, paragraph 1, lines 1-2, the wording "so the speed of the source exceeds the wave speed", the wave speed being tacitly understood as being the light speed in vacuum, c, is again in direct violation of known laws of nature, i.e., the Special Theory of Relativity and the principle of causality, as previously recited. This objection remains essentially the same as previously applied, since applicant's response & arguments, supported by factual evidence including the affidavit submitted with the amendment, have failed to persuasively remove the prevailing objection. This conclusion agrees and is supported by the general opinion from scientific community commenting on applicant's invention in [PhysicsWeb2004], as cited above. As such, it provides a basis for the §101 rejections made in this office action (MPEP §2107.01/II).

(c) On page 7, paragraph 3, line 1, the wording "In the highly superluminal regime" is again in direct violation of known laws of nature by the same token as recited above, since the word "regime" is unambiguously representing a material object. This objection

remains essentially the same as previously applied, since applicant's response & arguments, supported by factual evidence including the affidavit submitted with the amendment, have failed to persuasively remove the prevailing objection. This conclusion agrees and is supported by the general opinion from scientific community commenting on applicant's invention in [PhysicsWeb2004], as cited above. As such, it provides a basis for the §101 rejections made in this office action (MPEP §2107.01/II).

(d) On page 27, paragraph 3, lines 7-8, the wording "this polarized region can be set in accelerated motion with a superluminal velocity" is again in direct violation of known laws of nature by the same token as recited above, since the word "region" is unambiguously representing a material object. This objection remains essentially the same as previously applied, since applicant's response & arguments, supported by factual evidence including the affidavit submitted with the amendment, have failed to persuasively remove the prevailing objection. This conclusion agrees and is supported by the general opinion from scientific community commenting on applicant's invention in [PhysicsWeb2004], as cited above. As such, it provides a basis for the §101 rejections made in this office action (MPEP §2107.01/II).

(e) Owing to the above objections, (a) to (d), and possibly still many others not yet discovered/identified by the Examiner, the credibility of the invention is very seriously put in question, for its obvious violation against known laws of nature, as previously recited. This objection remains essentially the same as previously applied, since

applicant's response & arguments, supported by factual evidence including the affidavit submitted with the amendment, have failed to persuasively remove the prevailing objection. In this regard, even the recitation of a "superluminal" source <u>distribution</u> must be considered incredible, unless it is accompanied by a careful definition that such source does not represent material objects. This has been also done in [Bolotovskii'1972], in which several pages long have been dedicated to prevent possible misunderstanding and misinterpretation. On the other hand, the present disclosure not only misuses the term "superluminal" many times, but also tries to stretch out Bolotovskii's teaching by subjecting it to "acceleration through the speed of light in vacuo" and "centripetal acceleration", the two new aspects regarding "acceleration" being absent in the original Bolotovskii's teaching.

As already recited in the previous office action, the applicant seems to vaguely follow Bolotovskii's definition, e.g., on page 2, paragraph 2, line 1, by reciting the word "*pattern*", such as in *"The speed of the moving <u>distribution pattern</u> may be superluminal",* and again on page 3, paragraph 3, lines 4-5, in *"whose distribution <u>patterns</u> propagate with a phase speed exceeding the speed of light in vacuo".* However, applicant's persistence of using terminologies that are already objected by the examiner has lead to the conclusion that applicant's vague statements are *<u>effectively overridden</u>* by applicant's more frequent and emphasized statements recited throughout the entire disclosure, claiming for "superluminal" velocities of *<u>material objects</u>,* e.g., on pg.4/line 8, reciting a *"<u>superluminally rotating source</u>".*

Further evidence for applicant's real confusion in interpreting his own nonmaterial "distribution pattern" as being a material object is documented in applicant's own article in Exhibit D, reciting in Appendix C, pg.6675, Col.1/11.11-12, a "Doppler effect", where there is in fact no radiating charge actually moves. As known to one of ordinary skill in the art, a Doppler effect is caused by a materially moving source, but never by a relative phase of the oscillation of the distribution of the emitting particles, which is the case in applicant's invention.

A similar opinion regarding applicant's confusion with the "Doppler effect" has been also raised by A. Hewish in Phys. Rev. E 62 (2) 2000, pg. 3007, Col.2/11.8-12, which exactly agrees with the examiner's opinion so far. In full agreement with A. Hewish comments in "Revolutionary Device Polarizes Opinion", Physics World 2000 (applicant's IDS filed 5/17/2004), hereinafter [IDS/PhysicsWorld'2000], also [PhysicsWeb'2004] and many others from the scientific community, the examiner disagrees with applicant's statement reciting a similarity between the pile-up of light wavefront with the Doppler effect: Applicant's spherical (3-dimensional) or circular (2-dimensional) wavefront essentially propagates with strictly luminal velocity c, as clearly shown in Fig.1 of this Office Action. The pile-up that produces wavefront envelopes, which eventually intersect to form a "cusp", is a mere result of a timely change of the relative phase of the distribution, and is essentially the same as the phase-shift in optical and/or ultrasonic beam steering. This timely change of relative phase distribution has been misconstrued by applicant as a light source that "*moves*" with "*superluminal velocity*". In reality, both are purely virtual imaginations.

A new evidence for similar misinterpretation is the previously cited statement made in Exhibit D, Fig.1(e) on page 3, reciting that the array curvature "*introduces centripetal acceleration in the moving polarized region*". Again, the "*movement*" of the polarized region is here misconstrued by applicant as being physically real, so as to render it capable of causing something real, such as "centripetal acceleration" that would allegedly generate radiation. Similar to the term "*moves*" with "*superluminal velocity*", applicant's "*centripetal acceleration*" is here also purely virtual. As generally known in the art, no virtual cause would ever be capable of producing something real.

(f) The examiner suggests to eliminate the misleading word *"superluminal"* and "*accelerated through the light velocity in vacuo*" <u>entirely</u> from the *disclosure.* As previously stated, the terminology "*superluminal*" is misleading and also inappropriate, because in fact there is *no superluminal speed* at all. A similar term, "*accelerated through the light velocity in vacuo*", is applicant's attempt to stretch out Bolotovskii effect beyond physical reality, as recited previously.

In addition to the previous citations taken from Atwater's textbook "Introduction to Microwave Theory", which here remains 100% in force because applicant has failed to effectively responded with persuasive arguments, further examples from the non-mechanical beam-steering area in optical communications and medical ultrasonic technology are presented in this office action in support of the previously cited prior art references of Hopwood et al. (USPAT # 4,749,995) in Col.2/11.40-47 in reference to Fig.1, and O'Donnell et al. (USPAT 4,809,184) in Col.4/11.30-35 and Col.5/11.20-30 in reference to Fig.1 (from PTO-892 of previous office action).

The examiner's standpoint is even supported and justified by the affidavit under 37 CFR 1.132 submitted on applicant's behalf. The affidavit's example of a pair of scissors "*whose tips are moving just below the speed of light* but the <u>*intersection of the blades*</u> *moves at a speed faster than the speed of light*" completely agrees with the examiner, that the material object itself (the scissors' tips or blades and the current or charge itself) does not move faster than light, whereas the "superluminally moving" intersection represents locally and materially different parts of the blade that are not interrelated to each other by any causality. This justifies the examiner's suggestion to eliminate every recitation of the word "superluminal" from the disclosure, since --as admitted by the affidavit-- <u>*there is in fact no superluminal movement (of material object) at all.*</u>

Withdrawal and Reinstatement of Previous §101 and §112 Rejections

8. A provisional withdrawal of all §101 and §112/¶.1 claim rejections has been made during the Personal Interview on April 14, 2004, pending the evaluation of the new evidences to be presented during and after the interview. Those new supporting documents have been fully considered. However, they failed to remove all the previous §101 and §112/¶.1 claim rejections. The submitted affidavit even has effectively supported the examiner's position. In consequence, the same §101 rejections based on an incredibility of the invention and/or its inoperativeness, as well as similar §112/¶.1 rejections based on non-enablement, and §112/¶.2 claim rejections based on indefiniteness, are reinstated and re-applied to the un-cancelled claims.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

9. Claims 21, 27, 61, 65, 74 and 78 are rejected under 35 U.S.C. 101 because the claimed invention is not supported by either a specific asserted utility or a well established utility.

These rejections are not based on applicant's failure to specifically assert any utility, but because the specific utility asserted by applicant is deemed incredible in the light of knowledge in the art, or speculation at best (see later citation of MPEP §2107.01/II). MPEP § 2107.01/II further states

> *An invention that is "inoperative" (i.e., it does not operate to produce the results claimed by the patent applicant) is not a "useful" invention in the meaning of the patent law. See, e.g., Newman v. Quigg, 877 F 2d 1575, 1581, 11 USPQ2d 1340, 1345 (Fed. Cir. 1989); In re Harwood, 390 F.2d 985, 989, 156 USPQ 673, 676 (CCPA 1968) ("An inoperative invention, of course, does not satisfy the requirement of 35 U.S.C. 101 that an invention be useful.")*

Claims 21, 27, 61, 65, 74 and 78 recite the limitations of a magnetization current or charge "distribution" having an accelerated motion with "superluminal" speed, or "through the speed of light", or "moving with a speed exceeding the speed of light in vacuo", the term "distribution" here understood in the art as being of the same nature as its members, i.e., the magnetization current or charge, which is a material object prohibited by the law of nature to have a speed exceeding that of light in vacuo. As already stated in the previous office action, such a violation of physical law(s) renders

the claim incredible when interpreted in the light of the specification, and hence, are not supported by any utility, whether well established or specifically asserted utility.

Insofar the examiner can ascertain from Exhibit A and the pertinent discussion, what applicant really means with a "distribution" having "superluminal speed" is no other than the phase of a (sinusoidal) voltage applied to the elements of a phased array under a specific condition that is well known in the art as a condition for beam forming/steering. To proceed with this office action, all limitations regarding charge or current distribution moving with "superluminal speed" are interpreted by the examiner as being identical to the condition for a phased array operating in a beam forming/steering mode. In this regard, there is no evidence that applicant's invention is distinguished from a conventional phased array antenna. Applicant's supporting Experimental Evidence (Exhibit A) fails to provide any evidence whatsoever (see later paragraph 43). Detailed technical background underlying this examiner's interpretation is described in later paragraphs and sections.

The independent claims 21 and 61 having been rejected under §101, all claims dependent thereof, i.e., claims 22-28, 30-32, 36-44, 50-56, 58-60 and 62-71 are also rejected under the same paragraph.

10. Claims 36 and 68 are rejected under 35 U.S.C. 101, because they are either incredible or inoperative, or both.

Claims 36 and 68 are deemed inoperative and incredible in light of general knowledge in the art, since it has been shown that the decay characteristic as claimed is produced by a conventional phased array that has been specifically disclaimed by

applicant. Furthermore, since applicant's device basically is no other than conventional a phased array antenna operating in the beam steering mode (see later paragraph/section 43), the device is factually incapable of producing the claimed result, specifically regarding the limitation "without significant attenuation". In the contrary, Applicant's phased antenna array --as shown by applicant's Experimental Evidence, Exhibit A-- is even less efficient (i.e., more attenuated) than a conventional ~ $1/r^2$ radiation, since the ratio i_C/i_0 in reference to Figs. 11(a) to (d) of Exhibit D is obviously less than unity (see later section 43).

11. Claims 25 and 76 are also rejected under 35 U.S.C. 101 because they recite limitations that are inoperative, and hence lack utility.

Claims 25 and 76 add the limitation of "*a circle or arc of a circle*", i.e., a curvature, to the array in parent claims 21 and 72, respectively. However, as shown in a later section, while also being supported by numerous articles from the scientific community, the claimed radiation behavior is known in the art as an inherent property of a phased array in beam steering mode, and hence, already encompassed in the parent claims alone.

Conventional phased array in the form of a circle or arc of a circle as depicted in Fig.1 of the disclosure, or any shape on an arbitrarily curved surface, is well known in the art as <u>conformal</u> phased array (<u>patch</u>) antenna, as conventionally used on the (curved) body of airplanes. See, e.g., (a) B. Wierig, "Conformal Array Research at FGAN", COST 284 MCM and Workshop, JINA 2002, Nice France (01/28/2002); (b)

Raffaelli et al. "Analysis and measurements of conformal patch array antenna on multiplayer circular cylinder", COST 260 Groups Meeting in Gothenburg (May 2-5, 2001); and (c) AFRL's Sensors Directorate, "Conformal Array Antenna Technology", <http://www.afrlhorizons.com/Briefs/Feb04/SN0310.html>. It is well known in the art that the intensity behavior of conformal phased array antennas is fully conventional, i.e., spherically decaying for $r \rightarrow \infty$. Also, there has been no "cusp" or similar non-conventional or extra-ordinary property ever observed and reported.

Therefore, the claim limitation (i.e., a circle or arc of a circle) literally *does not operate to produce the results claimed by the patent applicant*, i.e., a non-spherical decay behavior of the radiated intensity (see also sections 17 and 27). Being incredible and inoperative, claims 25 and 76 do not have any specific asserted utility (MPEP § 2107.01/II). The lack of well-established utility of applicant's experimental array design will be discussed in detail in a later section 43.

Despite the lack of well-established and/or specific utility, applicant is of course allowed to make his antenna array as crooked as desired. Therefore, prior art rejections will still be made regarding claims 25 and 76.

12. Claim 57 is rejected under 35 U.S.C. 101 because it is <u>inoperative</u> and therefore lacks utility.

Claim 57 recites a means for generating "*a current or charge distribution ... <u>without</u> a phased array antenna.*" However, the particular antenna described in the disclosure (Fig.1), or even the specific antenna structure introduced as <u>New Matter</u> in

Exhibit A,D, is understood by one of ordinary skill in the art as being <u>no different</u> and <u>nothing else</u> than a phased array antenna. The curvature of the array and the DSB/SC modulation thereby used do not distinguish applicant's claimed invention from the conventional phased array antenna operated in a beam forming/steering mode, as evidenced by the examiner's back-of-the-envelope calculation (see later) and in agreement with general finding in the scientific world (e.g., A. Hewish in Mon. Not. R. Astron. Soc. 280 (1996), hereinafter [Hewish'1996], Science Vol.301, No. 5639, 09/2003, pp.1463-1465, hereinafter [Science'2003]), [PhysicsWeb'2004], and etc.). As described previously, even if an array is excited by a single pulse successively applied to the array elements one after another, in such a manner so as to give a virtual impression of "superluminally moving distribution", it is still a phased array antenna by the literal meaning of the words. Thus, claim 57 is deemed inoperative, since it cannot possibly operate otherwise than as a phased array antenna.

Since there is no alternative possibility of interpreting the claim limitation in light of the specification to be other than a phased array antenna, which is specifically <u>disclaimed</u> by applicant, claim 57 is <u>no further examined on the merit</u>, and is additionally rejected under 35 USC 112/¶.2 as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

13. Claims 67-71 depend on previously rejected claim 61. Consequently, claims 67-71 are also rejected along with their parent claim under 35 U.S.C. 101.

Claim Rejections - 35 USC § 112 / 1st paragraph

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

14. Claims 21, 25, 27, 36, 57, 61, 65, 68, 74, 76 and 78 are jointly rejected under 35 U.S.C. 112, first paragraph. Specifically, since the claimed invention is deemed inoperative, and hence, not supported by either a specific asserted utility or a well established utility for the reasons set forth above (see previous §101 rejections: *"An inoperative invention, of course, does not satisfy the requirement of 35 U.S.C. 101 that an invention be useful."* MPEP § 2107.01/II), one skilled in the art would not know how to use the claimed invention. As such, the claims are defective under 35 U.S.C. 112, first paragraph.

To proceed with this office action, all limitations regarding charge or current distribution moving having "superluminal speed" are interpreted by the examiner as being identical to the condition for a conventional phased array operating in a beam forming/steering mode, whereas the term "accelerated to superluminal speed" is understood in the art as being identical to the conventional condition for beam <u>scanning</u> and/or beam <u>focusing</u> well known in RF and optical communications. There is no evidence whatsoever that applicant's invention is distinguished from a conventional phased array antenna. Detailed technical background underlying this examiner's interpretation is described in later paragraphs 43 and 44.

15. The independent claims 21 and 61 having been rejected under §112/¶.1, all claims dependent thereof, i.e., claims 22-28, 30-32, 36-44, 50-56, 58-60 and 62-71 are also rejected under the same paragraph in conjunction with the previous § 101 rejections.

16. Claims 27 and 78 are also rejected under 35 U.S.C. 112, 1st paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 27 and 78 are both based on a non-enabling disclosure due to a contradiction found between the definition, description and derivation of a cusp, as given in the disclosure, and the experimental data (see later section "Evaluation of Applicant's Experimental Data"), as well as between the disclosure and the general knowledge in the art, as described in a later section; the contradiction effectively result in a strong doubt regarding the existence (which depends on a proper definition and interpretation of what is meant by a "cusp"), and more importantly, the advantages of such a "cusp" .

17. Claims 28, 37, 44 and 66 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement.

Claims 28, 37, 44 and 66 recite a means or method for focusing the pulse of radiation generated by applicant's invention, such means or method being completely absent from the disclosure, nor are they well known the art.

To proceed with the examination, the means or method for focusing the pulse of radiation generated by applicant's invention is specifically provided by forming a "cusp", the latter being supposedly a unique result of the array curvature. However, there is no evidence whatsoever, whether or not such a cusp really exist. Therefore, claims 28, 37, 44 and 66 are also rejected under 35 U.S.C. § 101. In this case, applicant's experimental evidence (Exhibits A, D) does not provide any convincing or persuasive evidence, either (see later section 43). Furthermore, it would be a New Matter if the specific antenna structure is incorporated in the disclosure.

Another possible interpretation of applicant's "focusing" effect would be an alleged result of (non-existent) "radial acceleration", such as a circular "superluminal motion" around the cylinder surface depicted in Fig.1 of the disclosure. Such a circular excitation of cylindrical arrays are well known in Conformal Phased Arrays, as described previously in section 11 under 35 U.S.C. 101 rejection (see also sections 11 and 27).

18. Claim 28 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement.

Claim 28 recites the limitation of a "*synchrotron*", which is known in the art as a vacuum device containing an energetic beam of *real charged particles* that cannot be accelerated to superluminal speed because of its real mass and its inevitable violation

of the causality principle. A charge "distribution" that does not represent the charge itself and evidently also radiates is known in the pertinent art as plasma wave; the pertinent plasma can thereby be either electrically uncharged or effectively charged. The condition for an imaginative "superluminal velocity" V_d applied to plasma waves is understood in the art as being a condition to be satisfied by the phase velocity of the plasma wave, the latter may well exceed c, as governed by the pertinent dispersion equation (but not worth to mention). In the alternative, the "superluminal" motion of the plasma distribution may be also referred to the group velocity of a plasma wave, apart from the question, whether or not a "superluminal" group velocity is possible with regard to the Special Theory of Relativity. The bottom line is, plasma wave is not a subject matter of applicant's invention. It would be New Matter if introduced hereafter.

Whichever interpretation applicant's charge "distribution" may be assigned to, a synchrotron as recited in claim 28 is essentially no other than some form of plasma filled waveguide with an unspecified provision that would allow the radiation to come out. In its broadest interpretation, applicant's synchrotron waveguide may be a partially-open waveguide, in which the plasma may be only partially enclosed, or better still, it may be some kind of plasma stealth antenna that emits highly directive radiation similar to a phased array antenna (see <http://www.aeronautics.ru/plasmaantenna.htm> and <http://iron-eagles.tripod.com/articvles/active.htm>). Whatever the plasma wave might be, the specific features of the synchrotron waveguide and the particular manner how to produce the plasma, and more importantly, how to generate and manipulate the plasma

waves to acquire certain properties (e.g., its phase or group velocity) commensurate with the utility inherent to the claimed invention, are not enabled by the disclosure.

Consequently, claim 28, and hence, also claims 31-32 dependent thereof, are not further examined on the merits and excluded from all following office actions and final rejections.

19. Claim 28 is also rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim contains a subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 28 inherently has a well-established utility that does not need to be specifically asserted in the disclosure. Whatever the utility might be, the specific features of the synchrotron waveguide and the particular manner how to produce the plasma, and more importantly, how to generate and manipulate the plasma waves to acquire certain properties (e.g., its phase or group velocity) commensurate with the utility inherent to the claimed invention, are not enabled by the disclosure. In particular, the huge gap between the vague idea of a "synchrotron" and any possible working apparatus, the latter not generally known in the art, inevitably raises doubt as to applicant's possession of the claimed invention at the time of filing.

Consequently, claim 28, and hence, also claims 31-32 dependent thereof, are not further examined on the merits and excluded from all following office actions and final rejections.

20. Claim 28 is also rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling.

Although the claim limitation does not violate any known law of physics, the specific features of the synchrotron waveguide and the particular manner how to produce the plasma, and more importantly, how to generate and manipulate the plasma waves to acquire certain properties (e.g., its phase or group velocity) commensurate with the utility inherent to the claimed, all of which critical or essential to the practice of the invention but not included in the claim(s), are not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976)].

Consequently, claim 28, and hence, also claims 31-32 dependent thereof, are not further examined on the merits and excluded from all following office actions and final rejections.

21. Claims 28, 66, 72, 79 and 80 are also rejected under 35 U.S.C. 112, 1st paragraph, as failing to comply with the written description requirement. The claim contains a subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 28, 66, 72, 79 and 80 recite various limitations regarding "far field", "near field" or "near zone", in relation to the Fresnel distance, the latter being known in the art as defined by Eq.2 of this Office Action (see a later section 43). However, the relationship defined by applicant proves to be incorrect by many multitudes (see Eq.7 in section 43 of this office action). Furthermore, non-spherically decaying component is

inherent in light beams resulting from collective interference, such as laser beams and directional beams generated by phased arrays, as described below.

Specifically in relation to claim 72, it is true that laser radiation decays spherically in the "far field", but only if the distance is measured from the beam waist (see Eq.3 in Melles-Griot <http://beammeasurement.mellesgriot.com/tut_gaussian_beam_prop.asp>, "Laser Beam Measurement", hereinafter [Melles'Griot]). However, if the distance is measured from the collimating optics, the intensity decay behavior is non-spherical ($\sim 1/r^x$ with $x<2$) up to (many) multiples of the Rayleigh range. This is a fact well-known even to those only minimally skilled in the art, such as physics major undergraduates, and can be easily demonstrated by substituting the distance variable z in the conventional formula for Gaussian beams (which is conventionally measured from the beam waist) with a distance z' measured from the collimating optics $z'=z+f$, with f being the focal length of the collimating optics, resulting in a decay behavior that has a non-spherical component $1/r^x$. The non-spherical behavior can also be seen by plotting the intensity ratio as a function of this new distance variable z', i.e., $I(z')/I_0(z')= I(z')/(1/z'^2)$. The effect is more pronounced if the beam is focused. As can be easily discerned by one skilled in the art, such a non-spherical decay behavior is indicated in a figure on pg.5 of [Melles'Griot] for focal lengths up to 4 times the Fresnel or Rayleigh distance z_R. As known in the art, there is no theoretical limit for the z_R/f ratio that dictates such a behavior (but only practical limit).

22. Claims 36-43 and 50-55 are also rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling.

Claims 36-43 and 50-55 recite a means for generating a *broadband* radiation. While the experimental data (Exhibit A) using conventional antenna excitation at a carrier frequency (with or without modulation) does not to show any broadband radiation, under special circumstances described in the specification the device of the parent claim 21 may indeed generate a broadband radiation spectrum, i.e., in case the charge or current distribution consists of a single pulse of short duration δt, which is known in the art to produce a "shock wave" of electromagnetic radiation propagating in vacuum or free space (comparable to "sonic boom" in the atmosphere). However, as known in the art, the radiation emitted by such a shock wave is governed by the uncertainty principle relating the pulse duration, δt, to the radiation bandwidth, δv, i.e., $\delta v \cdot \delta t \approx 1$, such that their characteristics (Fourier spectrum) is hardly controllable (see, e.g., Bliznetsov at <www.cosis.net/abstracts/EGS02/00137/EGS02-A-01137.pdf>). A specific method to control the characteristics of the emitted *broadband* radiation in order to realize the utility as claimed, is not enabled by the disclosure nor recited in the claims.

Furthermore, claims 36-43 and 50-55 recite limitations inherently involving a process of transmitting a message that is useful to a recipient. However, a specific modulation technique to encode a desired message into the specific type of *broadband* radiation generated by applicant's device is not described in the disclosure, nor in the claims. As well known in the art, the variety of techniques for message encoding are so

numerous, but very specific as to the type of modulation, the pulse duration and the bandwidth of the radiation. While the encoding of harmonic wave fronts is conventional (e.g., by virtue of frequency or phase modulation; see [Souw'2003] (SPIE Opt. Eng. 42(11), 2003, pp.3139-3157), to utilize a *broadband* radiation generated by a single pulse shock wave here involved, the desired modulation has to be encoded into the shock wave, e.g., directly into the excitation pulse itself, for which there is no enablement provided by the disclosure (see above); neither is there any such method generally known in the art (note, the Fourier spectrum depends not only on the pulse duration δt, but primarily also on the shape of the pulse). Under such circumstances a general and very broad limitation as recited in claims 36-43 and 50-55 does not enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. More specifically, since applicant has failed to disclose the specific method to generate the shock wave and control the characteristics of the radiation in view of the uncertainty principle and/or Fourier transform, it would be even more impossible for one of ordinary skill in the art to devise a method to encode a desired message into such a radiation.

In summary, the specific technique of generating a *broadband* radiation by means of a shock wave and to control the radiation characteristics in view of the uncertainty principle and/or Fourier transform, and the specific modulation technique used to encode a desired message into the unspecified and uncontrollable *broadband* radiation, both of which are critical or essential to the practice of the invention but not

included in the claim(s), are not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976)].

Consequently, claims 36-43 and 50-55 are not further examined on the merits and excluded from all following office actions and final rejections.

23. Claims 36-43, 50-55 and 69-71 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 36-43, 50-55 and 69-71 recite limitations that inherently involve a process of transmitting a message useful to a recipient. However, the specific technique thereby used, or that can be used, to encode a desired message into the specific type of radiation generated by applicant's device is not enabled by the disclosure, nor by the claims. As well known in the art, the techniques of signal modulation to encode a message are so numerous, but very specific as to the type of modulation and the transmitting/receiving antenna, so that a general and very broad limitation as recited in claims 36-43, 50-55 and 69-71 do not enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. For more specific description of modulation techniques conventionally used in communications, please refer to [Souw'2003].

Consequently, claims 36-43, 50-55 and 69-71 are not further examined on the merits and excluded from all following office actions and final rejections.

24. Claims 36-43, 50-55 and 69-71 are also rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 36-43, 50-55 and 69-71 recite limitations inherently involving a process of transmitting a message that is useful to a recipient. However, a specific technique to encode a desired message into the specific type of radiation generated by applicant's device is not described in the disclosure, the specific problem (e.g., uncertainty principle, Fourier transform) has not even been identified, which consequently raises doubt as to applicant's possession of the claimed invention at the time of filing.

Consequently, claims 36-43, 50-55 and 69-71 are not further examined on the merits and excluded from all following office actions and final rejections.

25. Claim 57 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claim 57 --which depends on the previously rejected claim 52-- recites a means for generating "*a current or charge distribution ... without a phased array antenna.*" However, the particular antenna described in the disclosure and specifically described in Exhibit A is understood by one of ordinary skill in the art as being no different and

nothing else than a phased array antenna. The curvature of the array and the DSB/SC modulation thereby used do not distinguish applicant's claimed invention from the conventional phased array antenna operated in a beam forming/steering mode, as evidenced by the examiner's back-of-the-envelope calculation (see section 43) and in agreement with the general finding in the scientific world (e.g., [Hewish'1996], [PhysicsWorld'2000], [PhysicsWeb'2004], and [Science'2003]), as previously recited. Therefore, claim 57 seems to be in direct contradiction to the claimed invention, unless something else is thereby meant, which is neither adequately described in the disclosure, nor particularly pointed out and distinctively claimed by the recited limitation.

Since there is no alternative possibility to interpret the claim limitation in light of the specification other than a phased array antenna, which is specifically disclaimed by applicant, claim 57 is no further examined on the merit, and is additionally rejected under 35 USC 101 as being "inoperative", because it cannot possibly operate otherwise than as a phased array antenna. As described previously, even if an array is excited by a single pulse sequentially applied to the array elements in such a manner so as to give a deceptive imagination of a spatial distribution of charge carriers that is moving with "superluminal velocity", as claimed by applicant, such an array is still a phased array antenna (operating in a pulsed mode) by the literal meaning of the words.

26. Claims 60, 61 and 72 are also rejected under 35 U.S.C. 112, 1st paragraph, as failing to comply with the written description requirement. The claim contains a subject matter which was not described in the specification in such a way as to reasonably

convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 60, 61 and 72 recite the terms "far field", "near field" or "near zone", "Fresnel distance", and/or a non-spherically decaying radiation intensity characterized by a $1/R^x$ dependence with $x<2$. As described in the previous Office Action and in section 21 of this Office Action (regarding claims 28, 66, 72, 79 and 80), the radiation decay characteristics as claimed has been proven to be inherent to many conventional light sources, such as --at least, but not restricted to-- a laser beam and a beam steered by a phased array. Therefore, applicant's claim of such characteristics being typically generated by the claimed device by means of a mechanism as claimed in the specification, while implicitly <u>disclaiming</u> every conventional means, must be deemed "non-enabled" (if not even "inoperative").

Claim Rejections - 35 USC § 112/ 2nd paragraph

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

27. Claims 21, 27, 61, 64 and 65 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is not clear what is meant by *"accelerating"* the current or charge distribution recited in the claims, i.e., whether this acceleration is in the direction of the array, or perpendicular to it.

To proceed with this office action, all limitations regarding charge or current distribution that is "accelerated to superluminal speed" is understood in the art as being identical to the conventional condition for beam scanning and/or beam focusing well known in RF and optical communications as well as in medical ultrasound technology. In this case, the acceleration is in (i.e., along) the array direction, as described in Frequency/Phase Effects of Antennas, <http://www.keys.com/antenna/navy/freq-phase/freqphas.htm>, by Somer in "Phased Array and J. Somer", <http://www.ob-ultrasound.net/somers.html> and by Montebugnoli et al., in "Some Notes on Beam Forming", <http://www.ira.cnr.it/~skawork/documents/Beamforming-Eng.pdf>.

For a real-time demonstration as to how "acceleration" gives rise to beam-steering/scanning and/or beam-focusing, please refer to, e.g., [Phased Array Principle], available at the website URLs: <http://www.imasonic.com/Industry/PAprinciple.php> and < http://www.imasonic.com/Industry/PA3D.php>.

The method(s) of acceleration assumed by the examiner may be different than what applicant would like to mean, but the term "focusing" is generally known in the art as being no other than the specific method(s) of array excitation described in the references cited above. On the other hand, a "radial acceleration" allegedly generated by applicant's curved array, either according to Fig.1 of the disclosure or according to Exhibits A and D (note the difference to the original disclosure) does not generate any focused radiation, but only beam-formed directional radiation. Curved arrays similar to applicant's disclosure are well known in the art as Conformal Phased Arrays, as described in reference articles previously cited, i.e., Wierig, "Conformal Array Research

at FGAN", and Raffaelli et al. "Analysis and measurements of conformal patch array antenna on multiplayer circular cylinder". A full cylindrical array similar to applicant's Fig.1 is also depicted by Wierig on pgs. 3 and 4 (top right hand corner). As understood by those skilled in the art, <u>none of the conformal patch antenna references ever mentioned the word "superluminal"</u>, although their method of applying the excitation signals is substantially no different than applicant's. While various forms of conformal phased arrays are being operated and investigated all over the world, <u>none of them ever reported to have observed any extra-ordinary effect</u>, including anything like a less-attenuated <u>non-spherical decay behavior</u>, but nothing else than highly directional beam-formed radiation having conventional properties and conventional decay behavior. Furthermore, their directional radiation is emitted in the (r,φ) plane, but not in the (φ,z) plane as claimed in applicant's invention (Fig.1 of the disclosure). Therefore, applicant's "acceleration" must be either (a) something indefinite and unknown in the art, and hence, falls under present §112/¶.2 rejection, or (b) inadequately described in the disclosure, and hence, falls under §112/¶.1 rejection, or (c) non-existent, and hence, inoperative/incredible under §101 (see previous sections 11 and 17).

28. Claims 36 and 68 are also rejected under 35 U.S.C. 112, second paragraph, as being indefinite for reciting the limitation "*over long distances without significant attenuation*". The metes and bounds of the claimed subject matter, i.e., "long distances" and "significant attenuation" cannot be determined. The specification does not give

definite criterion regarding what "distance" is defined as "long" and what attenuation is defined as being "significant".

In order to proceed with this office action, the claim limitation is assumed to be comparable to that of laser beams and formed/steered beams from phased arrays, which are well known in the art as representing examples of radiation signals that propagate "*over long distances without significant attenuation*". This interpretation agrees with the attenuation measured in applicant's experiment (Exhibit A), as described previously. There is no evidence whatsoever that applicant's radiation is less attenuated than the two specific types of radiation cited by the examiner. In the contrary, the experimental data provided in Exhibit A, Figs.11(a) to (d), showing signal intensities significantly smaller than r^{-2} decaying radiation ($i_C/i_0<1$), justifies the examiner's interpretation of the indefinite claim.

29. Claim 37 is also rejected under 35 U.S.C. 112, second paragraph, as being indefinite for reciting the limitation "*<u>focused</u> at a specific region of interest, <u>distant</u> from the antenna*". The metes and bounds of the term "*distant*" cannot be determined. The specification does not give definite criterion regarding what is defined as being "*<u>distant</u>*" from the antenna.

In order to proceed with this office action, the claim limitation is assumed to be comparable to the focusing capability of laser beams and formed/steered beams from phased arrays, which are well known in the art as representing examples of radiation signals that can be "*focused at specific region of interest, at some <u>distant</u> from the*

antenna". There is no evidence whatsoever that applicant's radiation is focusable at regions more distant from the antenna than the two specific types of radiation cited by the examiner.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless -
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

30. Claims 21-24, 26, 27, 44, 56, 58-66 and 78 are rejected under 35 U.S.C.102(b) as being anticipated by Phelan (USPAT 6,611,230).

Phelan discloses an apparatus for generating electromagnetic radiation as expressly recited in Col.1/ll.18-26, comprising a polarizable medium 54 (i.e., a dielectric, per definition), as depicted in Fig.4 and recited in Col.7/ll.1-8, the dielectric 54 with conductor patch 12a, 12b, ... 12n forming the elements of an phased array antenna 10 also shown in Fig.3, as recited in Col.6/ll.38-45; and means 46 shown in Fig.3 of generating a polarization current distribution as recited in Col.6/ll.57-60, whose "distribution" --or more precisely and correctly, the relative phase of the distribution, as described in previous sections of this office action-- moves with a superluminal speed, which is inherent in Phelan's because Phelan's antenna array is inherently made for beam steering, as recited in Col.1/ll.12-26, wherein the "speed" of the charge "distribution", or more precisely, its relative phase, inherently moves with superluminal

speed, or exceeding the light speed in vacuo, which is generally understood in the pertinent art as being the conventional method of steering the beam using a phased array (as described in a previous paragraph in reference to Fig.1 of this office action), wherein the limitation of accelerating the "distribution" or phase is understood in the art as having the same meaning as "*beam* *focusing*", which is an inherent capability of Phelan's device (specifically anticipating claims 44 and 66), as recited in Col.1/ll.14-16, and wherein a non-spherically decaying electromagnetic radiation is inherent to a focused beam in general, as quantitatively demonstrated by the examiner's back-of-the-envelope calculation presented in sub-paragraph 43(j).

► Specifically regarding claim 23, Phelan's embodiment shown in Fig.2b includes an array of electrode pairs 18' and 22' positioned to each other along the dielectric medium 16', as recited in Col.4/ll.21-27. Phelan's phased array further comprises a voltage generator 26 in Fig.1 and/or 46 in Fig.3 and 4, for applying a voltage to the electrodes, as recited in Col.6/ll.57-60. The further limitation of "*sequentially at a rate sufficient to induce a polarization current in the medium whose distribution pattern moves along the medium with a speed exceeding the speed of light in vacuo*" is inherent in phased arrays operated in beam steering mode, as generally known in the art and extensively described in a previous paragraph discussing applicant's experiment, wherein the word "*sequentially*" is understood in the art as being a time delay applied to the phase of the individual element of the array, whereby the voltage may be applied either periodically and continuously, or only one time sequentially; the former as applied in applicant's experiment (Exhibit A), resulting in a (quasi) continuous

beam steering; the latter resulting in a single wave front known as a shock wave, which is a more general case recited in applicant's disclosure, both cases having been already explained in the previous paragraph.

► Specifically regarding claims 24 and 63, the limitation that the spectrum of the generated radiation contains frequencies that are higher than the frequency needed for generating the current or charge distribution and its modulation is also inherent in Phelan's, since an antenna array is inherently used for transmitting communication signals at a carrier frequency, this carrier frequency being inherently modulated by a modulation frequency containing the inherent communication code, thus generating a radiation that inherently contains the sum frequency of the carrier frequency and the modulation frequency, a sum frequency being inherently (i.e., per definition) higher than the carrier and the modulation frequencies. All these limitations are inherent in the single word "communication", which is recited by Phelan in Col.1/line 24.

► Specifically regarding claim 26, Phelan's dielectric medium 16 has a rectilinear shape, as can be seen in Figs.2a,b,c.

► Regarding claims 27, 44, 64-66 and 78, Phelan's means for accelerating or changing the speed of the (relative phase of the) charge distribution, and hence, focusing the beam, inherently generates wavefronts or wavefront envelopes that possess a cusp for a specific period of time, the cusp being understood in the art as being the meeting point for curved wavefront envelopes, as described in sub-paragraph

43(e). As such, a cusp is the same as a focal point, which is inherent in Phelan's phased array, as recited previously.

► Regarding claims 56 and 62, the limitation of spherically decaying radiation component is inherent in every transmitting antenna (see Fig 1a of this office action).

► Regarding claims 58 and 59, the limitation of the current/charge volume distribution being controlled by varying the applied voltage with respect to time is inherent to the use of time delay equivalent to phase delay appropriate for beam steering and/or focusing, as already described in the previous paragraph evaluating applicants experimental results.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C.103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

31. Claims 21, 22, 24, 26, 27, 44, 56, 58-66 and 78 are rejected under 35 U.S.C.103(a)) as being unpatentable over Geyh et al. (USPAT 6,184,832) in view of Phelan.

Geyh et al. discloses an apparatus for generating electromagnetic radiation as expressly recited in Col.1/ll.10-18, comprising a polarizable medium 500 (i.e., a dielectric, per definition), as depicted in Fig.4E" and recited in Col.8/ll.10-35, the

dielectric 500 with patch conductor 502 being part of an antenna array element 14, which is also shown in Fig.2, 2A and Fig.3, as recited in Col.3/ll.41-45; and means (30-32-18-36-38-28 shown in Fig.2A) of generating a polarization current distribution as recited in Col.8/ll.15-23, whose "distribution" --or more precisely and correctly, the relative phase of the distribution, as described in previous sections of this office action--moves with a superluminal speed, which is inherent in Geyh's because Geyh's antenna array is inherently made for beam steering, as recited in Col.1/ll.10-15, wherein the "speed" of the charge "distribution", or more precisely, its relative phase inherently moves with superluminal speed, or exceeding the light speed in vacuo, which is generally understood in the pertinent art as being the conventional method of steering the beam using a phased array (see Fig.1). The limitation of accelerating the "distribution" or phase is understood in the art as having the same meaning as "*beam scanning*", which is inherent in Geyh's device and method.

However, Geyh et al. do not recite the limitation of a non-spherically decaying electromagnetic radiation. As described in section 21 and in sub-paragraph 43(j), non-spherically decaying electromagnetic radiation is inherently generated as a result of beam focusing, which is rendered obvious by Phelan as applied previously in a § 102(b) rejection of the same claims.

It would have been obvious to one of ordinary skill in the art to give Geyh's phased array a focusing capability as taught by Phelan, since focusing a steered beam would result in a higher antenna gain and a more effective use of the transmitted power.

► Specifically regarding claims 24 and 63, the limitation that the spectrum of the generated radiation contains frequencies that are higher than the frequency needed for generating the current or charge distribution and its modulation is also inherent in Geyh's, since an antenna array is inherently used for transmitting communication signals at a carrier frequency, this carrier frequency being inherently modulated by a modulation signal representing the inherent communication code, thus generating a radiation that inherently contains the sum frequency of the carrier frequency and the modulation frequency, a sum frequency being inherently (i.e., per definition) higher than the carrier and the modulation frequencies.

► Specifically regarding claim 26, Geyh's dielectric medium 14 has a rectilinear shape, as can be seen in Fig.2.

► Regarding claims 27, 44, 64-66 and 78, Phelan's means for accelerating or changing the speed of the (relative phase of the) charge distribution --and thus, focusing the beam-- inherently generates wave fronts that possess a cusp for a specific period of time, the cusp being understood in the art as being the meeting point for curved wavefront envelopes, as described in sub-paragraph 43(e). As such, a cusp is the same as a focal point, which is inherent in Phelan's phased array, as recited previously.

► Regarding claims 56 and 62, the limitation of spherically decaying radiation component is inherent in every transmitting antenna.

► Regarding claims 58 and 59, the limitation of the current/charge distribution being controlled by varying an applied voltage with respect to time is inherent to the use of

time delay equivalent to phase delay appropriate for beam steering and/or focusing, as already described in the previous paragraph evaluating applicants experimental results.

32. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Phelan or Geyh et al. in view of Phelan, and in further view of Sanford et al. (USPAT 5,243,358), or alternatively, in further view of Wierig and Raffaelli et al. as previously cited in sections 11, 17 and 27.

Phelan or Geyh in view of Phelan show(s) all the limitations of claim 25, as applied previously to the parent claims 21, except the recitation of the polarizable medium (i.e., the antenna array) having the shape of a circle or arc of a circle.

Sanford et al. disclose an antenna array made of dielectric substrate in which the polarizable medium has a circular form, as recited in the abstract and shown in Fig.2. As can be seen in Fig.2, Sanford's circular array consists of annular components in the form of a circle, as recited in Col. 5/11.17-29 and Col.4111.15-26.

It would have been obvious to one of ordinary skill in the art by the time the invention was made to form Geyh's or Phelan's antenna array as a circular array, since the transmit beam formed by such an circular array has a particular beam symmetry and focusing property that would serve better a specifically desired purpose. Sanford's reason or motivation to modify the Geyh or Phelan reference may be different than what the inventor has done. However, it is not necessary that the prior art suggests the combination to achieve the same advantage or result discovered by applicant. In re

Linter, 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); In re Dillon, 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), cert. denied, 500 U.S. 904 (1991).

While specific features of applicant's experimental curved array as used in Exhibits A and D are neither recited in the disclosure nor in the claims, even if they would have been incorporated (New Matter!), such features would be known in the art as generating only <u>minor</u> and/or <u>conventional</u> modifications, distortions and/or non-homogeneities in the radiation characteristics that can be understood and analyzed by conventional physics and predicted by more rigorous calculations.

Conventional phased array in the form of a circle or arc of a circle (as claimed in Fig.1 of the disclosure), or any shape on arbitrarily-curved surface, is well known in the art as <u>conformal phased array (patch) antenna</u> conventionally used on the body of airplanes, as described by Wierig and Raffaelli et al. previously recited in reference to claim rejections under § 101 (section 11), § 112/¶.1 (section 17), and § 112/¶.2 (section 27).

33. Claims 60, 72, 73, 75, and 77-80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Phelan or Geyh in view of Phelan, in further view of the general knowledge in the art (as described in section 21, specifically addressing claim <u>72</u>) and Hewish, Mon. Not. R. Astron. Soc. 280 (1996), hereinafter [Hewish'1996].

Phelan or Geyh in view of Phelan show(s) all the limitations of claim 60, <u>72</u>, 73, 75, and 77-80, as applied previously to claim 21-27, except the <u>*explicit*</u> recitation of

generating electromagnetic radiation whose intensity attenuates at a rate of $\sim 1/R^x$ in a "far field", where R is a distance from the current/charge distribution and x is less than 2.

In view of the previously imposed §112/¶.1 rejections of relevant claims 28, 66, 72, 79, 80, and 60, 61, 72, specifically regarding applicant's definition of the "far field" in relation with the Fresnel distance, a decay rate of $\sim 1/R^x$ in the "far field" with $x<2$ is inherent to a radiation generated by collective interference, such as laser beams and directional beams steered by phased arrays. As generally known in the art, this property is even more pronounced in focused laser beams, focused phased arrays, as well as infinitely long linear arrays, the latter pointed out in [Hewish'1996] on pg.L28, col.1, lines1-20, in reference to Fig.1(a), reciting that radiation from an infinitely long linear phased array has a $\sim 1/R$ intensity dependence, since the length Δz of the antenna segment that contributes to the cusp wave front increases with the radius R of the observation or measurement, $\Delta z = \sqrt{(R \cdot \lambda)}/\sin\theta$, the $\sim 1/R^x$ decay behavior being also recited in Eq.12 above.

It would have been obvious to one of ordinary skill in the art by the time the invention was made to produce a directional beam steered by Phelan's or Geyh's phased array to generate a decay rate of $\sim 1/R^x$ with $x<2$, since such a non-spherical decay is desirable for being more efficient then the conventional $\sim 1/R^2$ (inverse square law).

► Specifically regarding the definition of Fresnel distance as a threshold between near-field and far-field zone recited in claims 79 and 80, this definition assumes only an vague and indefinite meaning or value, in view of the contradiction between applicant's

definition and understanding, as recited in the previous §112/¶.1 rejections of relevant claims 28, 66, 72, 79, 80, and further 60, 61, 72.

► Specifically regarding claims 73 and 77, Phelan's <u>dielectric</u> medium/substrate 16 has a rectilinear shape, as can be seen in Figs.2a,b,c.

► Specifically regarding claims 73, Phelan's dipole antenna having dielectric medium 16 may not be exactly the same as applicant's antenna as described in Exhibits A and D. However, such a dielectric antenna structure is neither recited in the claim, nor in the disclosure. Therefore, Phelan's antenna structure is here sufficient to obviate applicant's claim(s). In case applicant would modify the claim by incorporating the antenna structure as used in Exhibits A and D, such a dielectric antenna structure is well known in the art as "patch antenna", which can be used as an alternative or substitute, i.e., a modification, of Phelan's dipole antenna, as described in detail in a later paragraph 43, sub-paragraph (i).

34. Claim 74 is rejected under 35 U.S.C. 103(a) as being unpatentable over Phelan or Geyh et al. in view of Phelan, and in further view of the general knowledge in the art and Hewish'1996.

Claim 74 recites the same limitation as claim 23 that has been previously rejected under §102(b) as being anticipated by Geyh et al. or Phelan. Consequently, claim 74 is rejected also over Geyh et al. or Phelan, but now with the general knowledge in the art and Hewish'1996 as additional prior art, for being dependent on claim 72.

35. Claim 76 is rejected under 35 U.S.C. 103(a) as being unpatentable over Phelan or Geyh et al. in view Phelan, and in further view of Sanford et al., or Wierig and Raffaelli et al., and Hewish'1996.

Claim 76 recites the same limitation as claim 25 that has been previously rejected over Phelan or Geyh et al. in view of Phelan and Sanford et al., or Wierig and Raffaelli et al.. Consequently, claim 76 is rejected also over Phelan or Geyh et al. in view of Phelan and Sanford et al. or Wierig and Raffaelli et al., but now with Hewish 1996 as additional prior art reference for being dependent on claim 72.

36. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Phelan or Geyh et al. in view of Phelan, and in further view of Wicks et al. (USPAT 5,351,053).

Phelan or Geyh et al. in view of Phelan show(s) all the limitations of claim 30, as applied previously to the parent claim 27, except the recitation of a spectrometer and a detector. Wicks et al. disclose in Fig.3, 8 and 10 a radar system using a phased array transmitter antenna that is based on frequency offset principle, which is also well known in the art besides the more conventional principle based on phase shift or time delay as in Geyh's or Phelan's.

It would have been therefore obvious to one of ordinary skill in the art at the time the invention was made to substitute Wick's phased array transmitter antenna with Geyh's or Phelan's phased array transmitter antenna to have the transmitted power more concentrated on the target, in order to have a stronger target signal. Wick's

receiver system comprises a spectrum analyzer, as shown at the bottom of Fig.3, 8 and 10 and recited in Co.7/ll.40-45. As known in the pertinent art, a spectrum analyzer is no other than a spectrometer for the radio frequency range. Besides the RF spectrometer, Wick's receiving system inherently makes use of a detector, since otherwise no return signal would be detected. The inherent use of detector is recited by Wick et al. in Col.2/ll.10-14,

In summary, Wick's system comprises a spectrometer (spectrum analyzer), a detector and a phased array antenna as radiation source, the latter here substituted by Geyh's or Phelan's phased array antenna to render obvious applicant's claim 30; the reason or motivation to combine Wick's with Geyh's or Phelan's having been recited above.

37. Claim 66 is additionally rejected under 35 U.S.C. 103(a) as being unpatentable over Phelan or Geyh et al. in view of Phelan, and further in view of Apa et al. (USPAT 6,545,630).

Phelan or Geyh in view of Phelan show(s) all the limitations of claim 66, as applied previously to the parent claim 61, except the recitation of generating intense focused pulses with high frequencies in a near zone.

To generate an intense focused pulses onto a small spot is well known from the related field of ultrasound technology as used for medical therapeutic purposes, and hence, also obvious to one of ordinary skill in the art. Support for this official action is plentiful. In particular, Apa et al. disclose an apparatus for generating electromagnetic

radiation similar to Geyh's or Phelan's. However, Apa's apparatus explicitly and expressly recites to have a capability of generating intense focused pulses of high frequency radiation, as recited in Col.11/ll.42-56.

It would have been obvious to one of ordinary skill in the art by the time the invention was made to add to Geyh's or Phelan's phased array antenna a focusing capability as taught by Apa et al., since focused radiation can be used with higher efficiency to achieve the intended objective than an unfocused collimated beam.

Examiner's Response to Applicant's Arguments

38. Claims 30-35 and 45-49 having been cancelled, the previous rejections of claims 30-35 and 45-49 for reciting a use without setting forth any steps involved in the process, have been withdrawn.

39. The objections regarding the use of some terminologies have been withdrawn in a previous paragraph.

40. Regarding the Rayleigh or Fresnel range and the $1/R^2$ dependence of the laser beam intensity, applicant has misinterpreted the examiner's statement on page 3 of the previous office action, which literally recites "*A classic example is the previous example of a laser beam, which is basically a superposition of a whole bunch of mutually interfering electromagnetic plane waves having (slightly) differing propagation directions. Nobody would expressly appeal for attention that laser beams do not "decay at a rate of R^{-2}"*. Indeed, well-collimated laser beams (as opposed to divergent laser

beams) do not (rigorously) "decay at a rate of $1/R^2$", but do so only asymptotically, i.e., at a distance $z \rightarrow \infty$, or at least for z >>(much greater than) z_R. That in the far field a laser beam also decays spherically is already well known even to undergraduate students. But that is only true if the distance is measured from the beam waist, as discussed previously (see [Melles'Griot] and/or [Souw'Handbook]). If the distance is measured from the collimating optics, the decay behavior has non-spherical components up to many multiples of the Rayleigh range (see previous §112/¶.1 rejections of claims 28, 66, 72, 79, 80, and further 60, 61, 72).

As a matter of fact, the examiner has tried to explain these circumstances already during the 04/14/2004 interview. The derivation of Eq.6a,b, and its asymptotic behavior shown in Fig.6 unambiguously and coherently prove the correctness of the examiner's position, in full agreement with the general knowledge in the art. Applicant's position regarding the alleged disappearance of any interference effect for distances larger than the Rayleigh distance has been also contradicted by the facts taken from phased array beam steering as known in optical and microwave space communications. Specifically, applicant's contention that "*every interference effect vanishes for distances larger than the Rayleigh distance*", as expressed during the 04/14/2004 interview, is just the opposite of the knowledge in the art based on Huygens-Fresnel diffraction theory, which states that for observation points at distances larger than the Rayleigh distance (Eq.2) all wavelets originating from source points over the entire emitting surface contribute by way of interference to the total intensity measured at that observation

point. This interpretation agrees with Hewish [Hewish'1996], as cited in Eq.3 above, also with a university lecture [PH3310] cited previously.

41. The examiner has never misunderstood applicant's electromagnetic waves as moving with superluminal speed, as alleged by applicant on pg.14/lines 1-3. On the other hand, the examiner has properly identified applicant's self-contradicting interpretation of the wording "superluminal source" throughout the disclosure, even if the word "distribution" is thereby added. As already discussed in a previous paragraph, in many passages of the disclosure the ambiguous wording "current or charge distribution" has been (mis)construed by applicant as being a truly material object, e.g., on pg.4, line 8, reciting a "superluminally rotating source", and recently in Exhibit D, in reference to Fig.1(e) on page 3, reciting that the array curvature "*introduces centripetal acceleration in the moving polarized region*". The "superluminal" movement (***V***) itself being already a virtual imagination that does not really exist (and hence, is never used in the art jargon), its mathematical derivative, i.e., acceleration = d***V***/dt, is a further stretch into a higher level of imagination that is even further remote from physical reality.

What applicant really means with moving at "superluminal" velocity is no other than the relative phase of the distribution (see also Hewish'2000), but not the source itself, since the latter violates the known law(s) of nature. Applicant's repeated attempt to interpret the wording as a material source that allegedly emits electromagnetic radiation has inevitably prompted a renewed or reinstatement of § 101 & § 112/¶.1 rejection. One of ordinary skill in the art understands that the wavefront envelope of the

emitted radiation is formed not because the "<u>source</u>" is moving with "superluminal" velocity, as alleged by applicant, but merely because the <u>phase</u> of the source distribution has been timely advanced or delayed according to the conventional condition for beam forming/steering. No "superluminal" movement is thereby involved.

The radiation generated in applicant's experiment is not at all caused by a "superluminal" velocity of the distribution, as alleged by applicant, but merely by the displacement term d***D***/dt in Bolotovskii's Eq.9, which is inherent in an oscillating dipole having a capacitive load or impedance, irrespective thereof, whether or not the phase velocity is "superluminal". The beam steering effect is solely caused by the relative phase shift of the oscillating dipole, and has nothing to do with its alleged "superluminal" velocity. Therefore, the terminology "superluminal" is deemed misleading, and hence, incredible. Even more incredible and speculative is applicant's term, "accelerated through the speed of light in vacuo", which must have been purely invented by applicant by stretching out the Bolotovskii's effect beyond physical reality.

Applicant's acceleration is inherent in the oscillating behavior of the charges or displacement current in the direction perpendicular to the array direction, thus forming an array of oscillating dipoles, each array element having the same frequency f_0=552.7 MHz and provided with a small <u>phase-slip</u> from one dipole element to the next, as depicted by the upper curve in Fig.5 of applicant's "Description of an experiment", or Fig.2(b) of applicant's "Experimental demonstration ...." papers. Thus, if there is any acceleration in the experiment, it is the acceleration of an oscillating dipole (perpendicular to the array) which causes the emission of radiation in applicant's

experiment, but not a source (or charge or current or its distribution) that moves with "superluminal" velocity in the longitudinal direction (along the array), let alone because the array curvature "*introduces centripetal acceleration in the moving polarized region*" which is enabled by the unique design of the array, because "*the displacement current not only has a vertical component but also a* <u>*radial*</u> *(sic!) component*".

The existence of a cusp allegedly formed as an intersection of curved envelopes is factually not established due to an obvious contradiction with the experimental geometry. The fact that the experimental geometry coincides with the geometry of a linear phased array, but not with the disclosure (Fig.4), is a strong indication that the measured effect is not caused by the cusp or any "superluminal" motion, or its "acceleration through the speed of light in vacuo", but nothing more than a conventional beam forming-steering-focusing by a phased array already well known in the art. As a matter of fact, the term "superluminal" phase velocity is never used in the art of beam steering, since it is factually misleading, whereas the "acceleration through the speed of light in vacuo" is beyond physical reality.

Not only for these reasons has the examiner suggested to eliminate from the disclosure the misleading terms "<u>superluminal source</u>", "acceleration through the speed of light in vacuo", and the likes, as, e.g., on pg.4/line 8, "superluminally rotating source", which would not exist even in a rotating pulsar.

EVALUATION OF APPLICANT'S EXPERIMENTAL DATA

Preliminary Remarks

42. The followings are citations from the Manual for Patent Examining Procedures (MPEP) relied upon by the examiner throughout this office action:

42.a. In case of §101 and §112/1.1 rejections based on incredible invention or lack of utility, references maybe cited regardless of their publication date:

> **MPEP § 2107.02/IV/IV** (underlines added by the examiner): *"The prima facie showing must be set forth in a well-reasoned statement. Any rejection based on lack of utility should include a detailed explanation why the claimed invention has no specific and substantial credible utility. Whenever possible, the examiner should provide documentary evidence regardless of publication date (e.g., scientific or technical journals, excerpts from treatises or books, or U.S. or foreign patents) to support the factual basis for the prima facie showing of no specific and substantial credible utility. If documentary evidence is not available, the examiner should specifically explain the scientific basis for his or her factual conclusions."*

42.b. A prima facie showing based on the examiner's personal knowledge is permissible:

> *37 CFR § 1.104 (c)(3) (emphasis added by the examiner): In rejecting claims the examiner may rely upon admissions by the applicant, or the patent owner in a reexamination proceeding, as to any matter affecting patentability and, insofar as rejections in applications are concerned, may also rely upon facts within his or her knowledge pursuant to paragraph (d)(2) of this section.*
>
> *37 CFR § 1.104(d)(2) (emphasis added): When a rejection in an application is based on facts within the personal knowledge of an employee of the Office, the data shall be as specific as possible, and the reference must be supported, when called for by the applicant, by the affidavit of such employee, and such affidavit shall be subject to contradiction or explanation by the affidavits of the applicant and other persons.*

42.c. An Affidavit written by D. Rickel as an expert's opinion on applicant's behalf, filed 05/17/2004 under 37 CFR 1.132, might be effective for a prior art rejection, but is essentially of little weight in case of a § 112/¶.1 rejection based on non-enablement:

MPEP § 716.01(c) Probative Value of Objective Evidence (emphasis added)

> *Although factual evidence is preferable to opinion testimony, such testimony is entitled to consideration and some weight so long as the opinion is not on the ultimate legal conclusion at issue. While an opinion as to a legal conclusion is not entitled to any weight, the underlying basis for the opinion may be persuasive. In re Chilowsky, 306 F.2d 908, 34 USPQ 515 (CCPA 1962) (expert opinion that an application meets the requirements of 35 U.S.C. 112 is not entitled to any weight; however, facts supporting a basis for deciding that the specification complies with 35 U.S.C. 112 are entitled to some weight); In re Lindell, 385 F.2d 453, 155 USPQ 521 (CCPA 1967) (Although an affiant's or declarant's opinion on the ultimate legal issue is not evidence in the case, "some weight ought to be given to a persuasively supported statement of one skilled in the art on what was not obvious to him." 385 F.2d at 456, 155 USPQ at 524 (emphasis in original)). In assessing the probative value of an expert opinion, the examiner must consider the nature of the matter sought to be established, the strength of any opposing evidence, the interest of the expert in the outcome of the case, and the presence or absence of factual support for the expert's opinion. Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 227 USPQ 657 (Fed. Cir. 1985), cert. denied, 475 U.S. 1017 (1986). See also .... In re Beattie, 974 F.2d 1309, 24 USPQ2d 1040 (Fed. Cir. 1992) (declarations of seven persons skilled in the art offering opinion evidence praising the merits of the claimed invention were found to have little value because of a lack of factual support); Ex parte George, 21 USPQ2d 1058 (Bd. Pat. App. & Inter. 1991) (conclusory statements that results were "unexpected," unsupported by objective factual evidence, were considered but were not found to be of substantial evidentiary value).*

Although an affidavit or declaration which states only conclusions may have some probative value, such an affidavit or declaration may have little weight when considered in light of all the evidence of record in the application. In re Brandstadter, 484 F.2d 1395, 179 USPQ 286 (CCPA 1973).

Accordingly, only the experimental data submitted by applicant (Exhibit A) is here considered as *factual evidence.* Nevertheless, a complete response to Rickel's affidavit will be given later in this office action.

DETAILED EVALUATION OF APPLICANT'S EXPERIMENTAL DATA

43. This evaluation is subdivided into 14 subparagraphs:

43(a). Regarding "Superluminal Velocity and Centripetal Acceleration"

Applicant's invention relies heavily on Bolotovskii's charge or current distribution "pattern" that radiates a Cerenkov-like radiation when it moves with "superluminal velocity" (Bolotovskii et al., Sov. Physics Uspekhi 15(2) 1972, hereinafter denoted as [Bolotovskii'1972]). However, the experiment described in Exhibits A and D is fundamentally different than Bolotovskii's Cerenkov-like radiation in many aspects.

In Cerenkov radiation a true superluminally-moving charge would be the source for the radiation, e.g., a hypothetical tachyon in vacuum ([Bolotovskii'1972], pg.185, 2nd column, 1st. full paragraph), or Sommerfeld's electron that radiates only if it (uniformly) moves with "superluminal" velocity ([Bolotovskii'1972], pg.185, col.2, lines 2-8). In Bolotovskii's Cerenkov-like radiation, the source of radiation is a timely varying bunch (or bunches) of charged particles apparently moving with "superluminal" velocity (Bolotovskii'1972, pg.185, col.2, 2nd full paragraph, lines 3-6). However, Bolotovskii's bunch(es) of charged particles radiates, irrespective thereof whether or not the pattern velocity is superluminal. This is emphasized by Bolotovskii on pg.190, col.1, 2nd. full paragraph, lines 4-6, "*It is also obvious that the source in question (spots) radiate also in the 'subluminal' regime*". Therefore, one of ordinary skill in the art would better call Bolotovskii's radiation "*Cerenkov-like*", to distinguish from the true Cerenkov radiation. Due to this "subluminal" radiation, it is not quite correct to call the Bolotovskii's "superluminal" case Cerenkov radiation and it is incorrect to stretch-out Bolotovskii's "superluminal" phase velocity into "*accelerated through the speed of light in vacuo*". The latter cannot be found in the original teaching of Bolotovskii et al..

In a particular case where Bolotovskii's bunch(es) of charged particles takes the form of periodic or harmonic oscillation known in the art as plasma waves, the bottom line remains the same: Plasma wave radiates, not because it is "superluminal"; "subluminal" plasma waves also radiate. The "superluminal" phase velocity only lends the emitted radiation a characteristic directional property. Plasma wave radiates *not* because its phase velocity is "superluminal", but because the timely change of the local plasma density resulting from bunching and debunching process provides the term d***D***/dt in Bolotovskii's Eq.9 on pg.185 (in the absence of true current $\boldsymbol{j} \sim \rho \boldsymbol{V}$). This fact is evidenced by the well known plasma antenna as disclosed by Moore (USPAT 3,914,766) and Anderson (USPAT 6,674,970), in which the phase velocity of the plasma wave is "superluminal", and further, by Schumacher (USPAT 4,912,367) and Ohkawa (USPAT 4,263,097) in case of slow, "subluminal" plasma waves. The "superluminal" phase velocity of plasma waves merely induces some phase correlation that lends the emitted radiation a highly directional character, such as in stealth plasma antennas (see, <http://www.aeronautics,ru/plasmaanetnna.htm>), hereinafter [Plasma-Antenna]. These characteristic radiation properties indicate that the physics underlying Bolotvskii's Cerenkov-like radiation is basically the same as those of beam forming and beam steering by a phased array, which is further augmented by the fact that the formula for the Cerenkov(-like) cone angle is exactly the same as the beam steering angle (see later).

43(a.1). The *first discrepancy* between the experiment and applicant's invention based on Bolotovskii's Cerenkov-like radiation is the fact that the radiation in the experiment is

conventionally generated by _*external antenna excitation*_, without any need of "superluminal" motion, let alone a displacement current or polarization current that "moves at superluminal velocity" or "accelerated through the velocity of light in vacuo", as postulated by applicant. It is the *externally applied voltage* which induces in the dielectric material the displacement term d***D***/dt in Bolotovskii's Eq.9. There is no need for a bunching-debunching process to generate the Cerenkov-like radiation in applicant's experiment. Therefore, no modulation is necessary, such as by 46 MHz in applicant's experiment. An excitation by the 552.7 MHz carrier frequency alone would be sufficient to give the radiation a directional character, provided a phase-slip is applied to the array elements to mimic a "superluminal" traveling wave antenna. This is no other than the principle of conventional beam forming and beam steering by phased array well known in the art. It would be more persuasive if applicant could show a hard evidence that the 46 MHz modulation is indeed necessary to generate the claimed radiation characteristics (see requirement (a) in sub-paragraph 43(n)).

43(a.2). The _*second discrepancy*_ between the experiment and the disclosure is the specific design of applicant's curved array, the latter having its narrow (curved) side and parts of the top (flat) side not covered by electrode. Not only is such a design different than what is claimed by the invention (i.e., a linear array that can be either straight or curved, not necessarily forming a full circle), but also it is also different than what is recited in the claims. While such a narrowing of limitations is permissible as an embodiment, applicant's disclosure, including the claims, does not make particular distinction between straight or curved array. Claims 26 and 77 recite a straight linear

array, claim 76 recites a curved or circular array, whereas all other claims do not make any distinction, thus encompassing both straight and curved arrays. In consequence, the present office action also does not make any particular distinction between the two design forms, while identifying their differences only if considered necessary, <u>without regard of the embodiment exampled by the experiment</u>.

The fact that applicant's dielectric strip has a 4-cm wide open part on its top not covered by electrodes (Exhibit D, Fig.1(e) on pg.3 and pg.4/ll.10-12), such that "*the displacement current not only has a vertical component but also a <u>radial</u> (sic!) component*", does not cause any acceleration that would eventually generate radiation. This is simply because there is no motion involved. The suggested "motion" of polarization current along the array (whether it is curved or straight) is 100% fictive. The conventional terminology used in the art is "phase delay" (see Eq.1(a)) or "time delay" (see Eq.1(d)), both without referring to any "motion". It must be emphasized, to call the non-vertical current component "*radial*" is incorrect (for suggesting a non-existent centripetal acceleration), because the component remains intact, even if the array is made substantially <u>straight</u>. No ordinary skill in the art would ever say that a <u>straight</u> array could have some "*<u>radial</u>*" component, simply because something that is straight cannot have a radius. The fact that the directional radiation remains intact even if the array is made <u>straight</u>, is a solid evidence that the radiation is not caused by the "acceleration" supposedly suffered by the "radial" component of the polarization current, the two terminologies under quotation marks being 100% imaginative. As stated previously, Bolotovskii et al. do not teach to subject their "superluminal" phase velocity

to "*<u>accelerated</u> motion through the speed of light in vacuo*", let alone to a "*centripetal <u>acceleration</u>*". Thus, applicant's attempt to stretch out Bolotovskii's teaching to the electrodynamics law of radiation due to <u>accelerated</u> charge is unpersuasive, since there is no inertial mass involved which could be referred to a real velocity or real motion along a curved path that would eventually cause a real centripetal acceleration.

Given applicant's experimental condition, in order to generate centripetal acceleration the array needs to be <u>physically moved</u> along a curved path. Therefore, the text to Fig.1(e) on page 3 of Exhibit D, reciting that the array curvature "*introduces centripetal acceleration in the moving polarized region*", is physically incorrect, and hence unpersuasive.

<u>43(a.3).</u> The *<u>third discrepancy</u>* is the inconsistency within the disclosure itself regarding the location of the "cusp", defined as an intersection between the *<u>envelopes</u>* of the wavefronts emitted by the array elements. This "cusp" is supposed to be a result of combining Bolotvskii's "superluminal" phase velocity with applicant's array curvature. However, according to the general understanding in the art, the locus of the cusp is not a (curved or spiraling) <u>line</u> as shown in Fig.4 of the disclosure, which extends in both $\pm z$ direction from the source's orbit plane of Fig.1, but rather, the locus of the cusp is <u>smeared out</u> in the φ angular direction due to the timely arbitrary position of Bolotovskii's single bunch of radiation source (S in Fig.1 of the disclosure), or the continuous positions of the source in case of Bolotovskii's plasma wave, thus leaving the locus of the cusp only as a function of z and the azimuthal angle θ. A detailed discussion will be given in a later sub-paragraph 43(e).

43(a.4). A *fourth discrepancy*, which is very important, follows from the inconsistency between the experimental set-up and applicant's disclosure regarding the position of the cusp locus relative to the orbit plane. According to applicant's Fig.4, the locus of the cusp stays confined within, or at least close to, a cylinder formed by the ±z extension of the circular orbit of the source denoted by circle S in Fig.1 (such a cylinder is completely absent in all applicant's figure drawings). This seems plausible, since the cusp as defined by applicant is understood as being the equivalent focal spot for the inwards-directed wavefront envelopes. However, the experimental observation points as depicted in Exhibit D Figs.3(a) to (d) not only are all measured on the outside the array curvature, but they also deviate very far from the z axis shown in Fig.4 of the disclosure. In fact, all measurements are made along an x-axis that is perpendicular to the z-axis of Fig.4 of the disclosure. These discrepancies are specifically shown in Fig.5B of this office action regarding the position relative to the array curvature, and in Fig.3 of this office action regarding the inconsistency in the axis of observation. A more detailed discussion is made in a later sub-paragraph 43(e).

The two inconsistencies discussed in sub-paragraphs 43(a.3-4) above strongly indicate a possible conceptual error regarding the cusp and its locus, which might well have occurred due to the multi-valued variable and parameters thereby involved. Therefore, it would be helpful if applicant provides a complete diagram of the locus of the cusp as in Fig.4 of the disclosure, but covering the distance range of the experiment, i.e., from z=0 to z=900m, which simultaneously also shows how this cusp

locus relates with the geometry of the experiment shown in Figs.3-11 of Exhibit D (see Fig.3 this office action).

It must be emphasized, the above inconsistencies regarding the existence and locus of the cusp --even if clarified-- do not have any impact on the rejections made in this office action, since all *prima facie showings* are totally based on the beam forming/steering/focusing technology, irrespective thereof, whether or not applicant's "cusp" exist.

43(b). <u>Excitation vs Modulation</u>

In applicant's experiment, a 46 MHz modulation is applied by means of a double-sideband suppressed-carrier (DSB/SC) technique. This can be recognized from the waveform shown in Fig.5, the latter being a DSB/SC waveform well known in the art, as shown by Ghassemlooy, Sheffield Hallam University, UK, hereinafter [Ghassemlooy], slide #5. It is further known in the art that the radiation spectrum of such an excitation consists of both the difference and sum frequencies ([Ghassemlooy], slide #3); these frequencies being taken for measurements made in the experiment (f+= 598.7 MHz, recited in Exhibit A, pg.3/line 4). More specifically, the spectrum of the radiation generated in applicant's experiment will not contain any other frequency beyond what is conventionally predicted by the DSB/SC modulation thereby used. If normal modulation (no carrier-suppression) is used, the carrier frequency (552.7 MHz) would also appear in the spectrum (Fourier spectrum, including higher harmonics as conventionally known in RF Engineering). In any case, the spectrum generated in applicant's experiment is 100% conventional, as generally understood by one of ordinary skill in the art. This

agrees with the comments made by A. Hewish cited in "Revolutionary Device Polarizes Opinion", Physics World, 2000 (applicant's IDS filed 5/17/2004), hereinafter [IDS/PhysicsWorld'2000], on pg.9/col.3/lines 16-22 from bottom: "*To be honest, Singleton is wasting his time," says Hewish. "Their device will merely radiate at exactly the same frequency as that of the applied electric field. It is a waste of tax-payers' money. It will end up a total disaster. I am 100% confident it will not work in the way they say it will.*"

As a matter of fact, a curvature is not even needed by the array to produce applicant's results. As already stated, the curvature does not cause the array to radiate. It is the excitation with f_C=552.7 MHz that causes the radiation, and it is the applied phase-slip, *not the array curvature*, that causes the emitted radiation to assume a highly directional character. As another matter of fact, the modulation with f_M=46 MHz has rendered the experiment much more complicated than it should be (see later). An antenna *excitation* (to be distinguished from "*modulation*") at the carrier frequency f_C=552.7 MHz facilitated with an appropriate phase-slip would have been sufficient to mimic applicant's "superluminal" phase velocity. Thus, both applicant's modulation by f_M=46 MHz and the 10^0 array curvature have no relevance, whatsoever.

A *further (fifth) discrepancy* between the disclosure and experiment is that the results of the experiment do not show a continuous distribution of higher frequencies, as presented in J. Opt. Soc. Am. A20 (11), 2003 (Exhibit B) in reference to Figs.6-9, and J. Opt. Soc. Am. A21 (5), 2004 (Exhibit C), in reference to pg.13/lines ***24-26***. In this regard, a continuous spectrum encompassing higher frequencies must be a direct result of the

uncertainty principle in the Fourier spectrum of a short pulse duration ([Bliznetsov], <http://www.cosis.net/abstracts/EGS02/00137/EGS02-A-01137.pdf>), and has nothing to do with the number of cycles along array curvature and/or the DSB/SC modulation, as claimed by applicant in Exhibit D/Eq.36 & Eq.2 (Table 1), Exhibit B/Eq.7 and Exhibit C/Eq.9a.

To clarify all these discrepancies it would be helpful if applicant provides a full spectrum of the measured signal covering the entire range from 46 MHz to f+=598.7 MHz on the same scale that allows intensity comparison. This will verify the examiner's conclusion regarding the <u>DSB/SC modulation</u> in relation with the previously cited Hewish's remarks [IDS/PhysicsWorld'2000], also to verify applicant's theoretical analysis presented in the supporting papers cited above, while indirectly proving the irrelevance of the 46 MHz modulation and the 10^0 curvature of applicant's antenna array.

In summary, the experiment has failed to support applicant's claimed invention for showing something quite different than what is claimed by the invention. Instead of showing Bolotovskii's Cerenkov-like radiation caused by rotating charge distribution, or Bolotovskii's plasma waves, the experiment merely shows a conventional antenna array <u>externally excited</u> by a carrier frequency and modulated by conventional DSB/SC technique. As stated earlier, this external excitation alone sufficiently provides the displacement term d***D***/dt in Bolotovskii's Eq.9, so that no bunching-debunching of charge or (polarization) current distribution, and hence, no modulation by 46 MHz, is necessary. This is in complete agreement with a general criticism launched by the

scientific community (see PhysicsWeb, <http://physicsweb.org/article/news/8/7/161> 07/29/2004, hereinafter denoted as [PhysicsWeb'2004]), which provides a basis for the § 101 rejections raised in this Office Action.

43(c). Comparison of Applicant's "Superluminal" Velocity to Beam Steering

In case that the phase-slip resulting from the time delay Δt is virtually imagined as "subluminal velocity", the radiation pattern is a superposition of radiation patterns from individual dipole elements (radiated into 4π radians), as illustrated in Fig.1A of this office action. Therefore, it is not at all surprising (for being fully conventional) that the radiation shown in Fig.1 Exhibit A obeys the inverse square law, since there is no beam forming/steering established under this condition. This is a fact generally known to those skilled in the art. However, if a phase-slip is consecutively applied to the array elements such that the phase structure can be associatively imagined as a "*superluminal motion*" of the current distribution pattern, spherical wavelets emitted by adjacent array elements will interfere constructively and generate an envelope tangential to the individual circular or spherical waves, this envelope representing a directional propagation forming an angle θ with the array (vector k in Fig.1B of this office action). As already stated in the previous office action, this is no other than the well-known principle of non-mechanical beam steering used in optical communications, high energy laser weapons and phased array antennas, and is equivalent to the same principle used in medical ultrasonic therapeutic devices.

To show the similarity between the principle of beam steering by phased array and applicant's imaginative concept of "*superluminal*" distribution or phase velocity in a

quantitative manner, we start with applicant's declared method of making the velocity "superluminal", i.e., by adjusting the time-delay Δt, which was set to 140 ps in applicant's experiment to simulate a *[source]* phase velocity of V_d=1.06 c (from applicant's Exhibit A, pg.4/lines 19-20, referring to the text of Fig.2(a)). This is exactly the same condition as in beam forming & steering using a linear array (as stated above, no 10^0-curvature is here needed). The beam steering principle is illustrated Fig.1B, which is to be compared with Fig.3 in the article "Frequency/Phase Effects of Antennas" available at <www.ewhdbks.mugu.navy.mil/FREQPHAS.HTM>, hereinafter denoted [Freq/Phase]). The definition of θ is here the same as in Fig. 1(a) on pg.L28 of Hewish's "Mon. Not. R. Astron. Soc. 280 (1996), L27-30, hereinafter denoted as [Hewish'1996], also the same as in Bolotovskii's Fig.9 (Bolotovskii'1972). To steer the beam to an angle θ, the optical path difference between adjacent parallel beamlets, $c\cdot\Delta t$, is set to satisfy $c\cdot\Delta t=d\cdot\cos\theta$, where Δt is the time delay between the array elements, θ is the angle formed between the propagation direction and the linear array (see Fig.1B), and d is the distance between adjacent array elements. The corresponding phase shift successively applied to the array elements is (see Polishuk et al. in Opt. Eng. 42(7) 2003, pp.2015-2024, hereinafter [Polishuk 2003], pg.2018, Eq.17; or [Freq/Phase], Fig.3):

$$\Delta\Phi=(d/\lambda)\cdot 2\pi\cdot\sin\theta_0=2\pi\cdot(d/\lambda)\cdot\cos\theta \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(1a)}$$

(Note the difference between Polishuk's definition of θ_0 and the angle θ in Fig.1B).

As shown in Fig.1B of this office action, this phase delay might be imagined as a "*phase velocity*" V_{phase}, expressed by

$$V_{phase} = d/\Delta t = c/\cos\theta \quad \text{.. (1b)}$$

In other words, the imaginative "*phase velocity*" V_{phase} must always be greater than c (i.e., always "superluminal"), in order a directional beam can be formed and steered by virtue of interference between the spherical (or circular) wave fronts emitted from the array elements. Otherwise, if $V_{phase} < c$, no beam forming occurs, and the array radiates in all 4π steradians having a far field characteristics resembling that of a dipole antenna (Fig.1A). Note that no modulation is necessary to establish the beam steering condition in a phased array.

Obviously, applicant has only considered the radiation under "subluminal" condition depicted in Fig.1A as "conventional", thereby ignoring the *conventional* phased array under beam forming/steering/focusing operating mode, which is widely used and well known in the art for many decades (see, e.g., Mohr et al., USPAT 3,736,535, issued 1973, as recited in col.1/ll.14-19).

43(d). Topological Comparisons

A comparison between applicant's disclosure with the conventional beam forming & steering technique by a phased array antenna clearly shows that the spiraling envelope(s) of wavefronts shown in Fig.1 and 3 of the disclosure is nothing else but a topological equivalent of the plane wavefront envelope(s) P (and Q) of the steered beam for the special case of applicant's cylindrical array. Fig. 1 of applicant's disclosure, which is reproduced in Fig.2 of this office action, only shows one snapshot of the envelope, produced by a single sequence of pulses along the array. In case of a harmonic oscillation of the "source" or "source distribution", as in Exhibit A and D, each

element of the "source" array emits a (quasi) continuous series of spherical waves in timely succession, as depicted in Fig.1B by the circles C4, C4', C4" .... etc. emitted from the array element # 4, and analogously C_n', C_n", C_n"" etc. from array elements # n, thus resulting in a series of envelopes as depicted by P, P', P", etc. (and also Q, Q', Q", etc.). One of ordinary skill in the art would easily understand that each of this wavefront envelope P is a topological equivalent of applicant's envelope shown in Fig.1 and Fig.3 of the disclosure, presuming that applicant's "source" is periodic and (quasi) continuous. It is to be noted that in applicant's experiment (Exhibits A and D) the antenna excitation is not only periodic but also harmonic (sinusoidal), thus resulting in isolated peaks in the frequency spectrum (Fourier transform). On the other hand, in case the source is not periodic, but a single bunch of Bolotovskii's charged particles [Bolotovskii'1972], or, in a case where each element of a linear antenna array is excited by a single short pulse one after another, the result would be just one single envelope forming a Cerenkov-like cone, known in the art as an *electromagnetic* <u>shock wave</u> (equivalent to a "supersonic boom") having a broadband Fourier spectrum [Bliznetsov].

Specifically in applicant's experiment, the higher harmonics denoted by a number "*m*" is/are not produced by the "*rotation of polarization current*", as claimed in Exhibit D/Eq.36 & Eq.2 (Table 1), Exhibit B/Eq.7 and Exhibit C/Eq.9a, but a mere result of applicant's auxiliary modulation by 46 MHz, as can be easily derived from Fourier analysis of the modulated radiation (to be proven by hard evidence; item (d) of sub-paragraph 43(n)). As described above, applicant's curved wavefront envelope is nothing else than a topological equivalence of the plane envelopes well known in

conventional beam steering. As such, the curved envelopes merely represent electromagnetic propagation vectors that are converging or diverging, which are also generated in beam forming and beam focusing by conventional phased arrays, as illustrated in J. Somer's "Phased Arrays and J. Somer", hereinafter [Somer] in reference to the figure on pg.5, by Montebugnoli et al. in "Some Notes on Beamforming", hereinafter [Montebugnoli], in reference to the figure on pg.2 and recited in lines 1-5 on the same page, and in the previously cited [Freq/Phase], in reference to Fig.3 on pg.3. This is now illustrated in Fig.2, which reproduces applicant's Fig.1, while depicting the positions of the wavefront envelopes at different time points. Similar curved wavefront envelopes are also known to be produced by lenses and mirrors. As generally known in the art, subsequent spectral analysis of the resulting radiation does not show any new or additional spectrum, spectral lines, or higher harmonics. Specifically regarding phased arrays, a focusing and/or defocusing envelope can be easily generated by a flat array (e.g., patch antenna) by electronically introducing additional phase shifts or time delays in a technique well known to ultrasonic (e.g., [Somer], [Montebugnoli]), as well as RF phased arrays (e.g., [Freq/Phase]). It would be more persuasive if applicant could show a hard evidence that applicant's measured spectrum would be substantially different in terms of higher frequency components than what is obtained from a <u>straight</u> linear array of the same design and operating parameters under the same modulation (see of sub-paragraph 43(n), item (c)).

In case of a <u>straight</u> linear array, a series of envelopes P represents the <u>*wavefronts* of a steered beam</u> propagating in a direction depicted by the arrow (k) in Fig.

1B. Thus, a periodic sequence of curved envelopes in applicant's case (as represented by the dashed curves P', P" drawn by the examiner to Fig.1 of applicant's disclosure, reproduced in Fig.2 of this office action) is a topological equivalent of plane envelopes P', P", etc., forming a steered-beam plane wave in Fig.1B. This equivalency can be easily comprehended by those of even less than ordinary skill in the art, simply by topologically unfolding the winding cylindrical geometry shown in applicant's Fig.1 (reproduced in Fig.2 of this office action) and mapping it into the examiner's plain linear geometry of Fig.1B. In place of applicant's spirally winding envelopes $\Phi\pm$, we get a family of plane parallel envelopes.

43(e). <u>The cusp and its locus</u>

Applicant's analysis deriving the cusp locus presented in Eqs.1 through 13 is confusing, especially with regard to what thereby considered as variables and which one parameters, and further, whether the parameter(s) is/are arbitrary or fixed. The cusp locus is also inconsistent with the experimental data, as recited previously. Therefore, it is much more appropriate to verify the claimed "cusp" by hard evidence, i.e., in terms of a significantly higher gain (see sub-paragraph 43(n), item (b)). It is to be strongly emphasized that applicant's experimental results, as presented in Exhibits A and D, failed to qualify as hard evidence, and hence, are <u>*not persuasive*</u>, because <u>***all***</u> the radiation characteristics claimed as being the exclusive results of applicant's invention can be adequately explained by conventional beam forming & beam steering/focusing theory <u>without</u> postulating or speculating the existence of any "cusp", as presented throughout this paragraph 6. It is to be noted, the inconsistency regarding the cusp and

its locus does not have any impact on all the rejections made in this office action, because the *prima facie showing* is 100% based on conventional beam forming & steering theory, without speculating the existence of a cusp. More specifically, the *prima facie showing* remains valid irrespective thereof, whether or not the postulated cusp really exist.

Some conceptual inconsistencies regarding the cusp locus are discussed below:

43(e.1). The definition of a cusp is given by applicant on pg.7 line 8, i.e., as being an intersection between wavefront envelopes ($\Phi\pm$), but more specifically on pg.7, in line 1 after Eq.12(b) and in line 2 after Eq.12(c), i.e., as being the intersection between *three* wavefronts, whereby the wavefront is defined on pg.6, lines 1-6. The specific number "three", while conforming with the illustration in Fig.1, is really confusing. This is because the illustration in Fig.1 (which serves as a basis for Fig.2 of this office action) is only an example or specific embodiment showing discrete array elements represented by points A2, A3 and A4, separated by an inter-elemental distance of ΔX, each emitting a spherical wavefront R2, R3 and R4, thus constituting a total of *three* (3) wavefronts. The "superluminal" phase velocity is here determined by Eq.1(b), $V_{ph}=\Delta X/\Delta T>c$. However, nothing will be changed when each element is subdivided into N smaller elements with an inter-elemental distance $d=\Delta X/N$, as long as the time delay between the new elements are correspondingly reduced to $\Delta t=\Delta T/N$, since the resulting phase velocity is the same, $v_{ph}=d/\Delta t=\Delta X/\Delta T=V_{ph}>c$. In this case, instead of 3 wavefronts as recited, the cusp at C is now an intersection of 3N wavefronts, which is the new number of (smaller) array elements along the circular orbit A4 to A2. Therefore, the examiner

disagrees with the number 3 (three) given by applicant, since in general there can be a large number of wavefronts that intersect each other to form a cusp at C; this number may even go to infinity in case of a continuous plasma waves (although still limited by the Fresnel-Huygens condition; see later). Since wavefronts R2, R3 and R4 have the same phase at the cusp C, one of ordinary skill in the art may conclude, the cusp is more like a diffraction "spot" rather than a focus, but only if it can be shown by <u>hard evidence</u> that it is truly a spot and not smeared out, as discussed next. There are at least two contra-indications that render the existence of the cusp to be seriously doubted in the light of knowledge in the art. These are discussed in 43(e.2) and 43(e.3) below.

<u>43(e.2).</u> As the source has moved one full circle (2π) along the linear array S in applicant's Fig.1, the cusp C on the light cylinder also has moved around the z axis by 2π (while moving to some distance $\pm\Delta z$ along the z axis, as illustrated in applicant's Fig.4). However, the parameter φ^ in Eq.1 --although it is fixed for a single pulse source-- in fact has an arbitrary value over time (the definition of φ^ as a Lagrangian coordinate on pg.5 line 5 from bottom does not alter the fact that it is effectively a variable, since there is no Lagrangian problem-solving method thereby executed, thus no Lagrange "solution" for φ^). This is especially true in case of a continuous source, such as Bolotovskii's traveling plasma wave. It would be more persuasive if applicant would define a particular value of φ^ and give a persuasive reason, why φ^ would have to take that particular value even though the array itself remains unspecified and rotation-symmetric, as in case of a traveling wave implemented in the experiment.

Otherwise, applicant has no choice except to agree with the examiner that in reality the locus of C is not a line along the ±z axis as illustrated in applicant's Fig.4, but smeared out $2n\pi$-fold around the z axis, leaving it --at most-- defined by the coordinates (θ,z) alone. This will destroy any significance of interpreting the cusp as a diffraction "spot".

A smear-out of the locus of C around the z-axis has a direct impact on the power or intensity distribution (Fig.4), conventionally expressed as the inverse cross sectional area of the beam, ~1/A, where $A=2\pi(R\cdot\cos\theta)(R\cdot\Delta\theta)=2\pi(x\cdot\tan\theta)(x\cdot\Delta\theta/\cos\theta)$ with $\Delta\theta\approx20^0$ (from Exhibits A,D). Based on these results, the far field intensity decay is $\sim1/A \sim 1/x^2$, i.e., in direct contradiction to applicant's claim, unless applicant is able to demonstrate by hard evidence that the intensity peak angle θ and/or the angular width $\Delta\theta$ is/are factually decreasing with the observation distance x. Otherwise, if both θ and $\Delta\theta$ are constant (cf. Exhibit D, Figs. 3, 4, 10, 11 and Figs.5-9, respectively), the inverse square law ($\sim1/x^2$) prevails in applicant's experiment. Note, a full circle of source is here not necessary; a small distribution over φ^ would be sufficient to provide for the missing dimension in applicant's analysis and thus destroy applicant's conclusion of non-spherical decay. This finding agrees with Hannay (cited in [PhysicsWorld'2000]) stating that no radiation source of applicant's type, no matter whether "superluminal" or not, is capable of generating non-spherically decaying radiation in the far field. It also agrees with general knowledge in the art that any radiation will inevitably decay as $1/R^2$ in the limit the source can be considered as a point source. Thus, the postulate of a "cusp" with all its alleged advantages is more likely to be a speculation. Possible error may be

mathematical artifact(s) due to improper consideration of the many multi-valued functions used in the derivation of the "cusp" (Eqs.1 to 13).

43(e.3). Whether or not the "cusp" is smeared out and indefinitely extends to $z \rightarrow \pm\infty$, there is an obvious inconsistency between the cusp locus as described in the disclosure and the geometry used in the experiment. A minor discrepancy, which may be just a result of mistaken illustration, is that the location of the "cusp" shown in Fig.3 of Exhibit D lie all on the outside of the curvature of the array, instead of inside it, as illustrated in Fig.4 of the disclosure. This discrepancy is specifically emphasized in Fig.5B of this office action, in which the array curvature is intentionally drawn to be the opposite of what is illustrated in Exhibit D, Fig.3(a)-(d). This discrepancy has no impact on the *prima facie showing* presented in this office action, since the latter is entirely based on a *straight* array without any curvature.

A major discrepancy is presented in Fig.3, showing the cusp locus according to applicant's Fig.4 as opposed to the observation geometry according to Exhibit D, Figs.3(a) to (d). More specifically, the experimental results shown in Figs. 4, 10 and 11 of Exhibit D show measurements taken at different cusp locations as a function of distance measured in reference to the x-axis that lies on the plane of the array and is tangent to it, as shown in Fig.3(a) and 3(b) of Exhibit D. This is totally incompatible with the geometry shown in Fig.4 of the disclosure, even if the latter refers to a different value of phase velocity V_d, and hence, a different value of θ, irrespective thereof, whether or not the cusp locus is smeared out in φ over $2n\pi$ radians as discussed previously. Fig.4 of the disclosure shows a cusp locus in that is a function of z,

perpendicular to the plane of the array. On the other hand, *all* the experimental results shown in Figs.3-11 refer to a cusp locus that is a function of x lying on the plane of the array. Most conspicuous is Fig.8, showing a symmetrical distribution in φ around the x-axis that is perpendicular to the z-axis of Fig.4 of the disclosure. Such a symmetry around the x-axis is recognized by those of ordinary skill in the art as being typical for a beam forming effect for a linear array, i.e., the symmetry of a Cerenkov-like radiation cone for a straight array (Fig.3 and Fig.5B). The full φ-symmetry shown in Fig.8 is consistent with the beam forming radiation pattern measured right on the surface of the Cerenkov-like cone, i.e., at $\theta=\arccos(c/V_{phase})$ (see Fig.5B). The fact that such symmetries have been measured over 900m distance is an unambiguous proof to one of ordinary skill in the art that the experiment does not provide evidence for what is claimed by the invention, but --in the contrary-- an evidence for a beam forming effect by a linear array, as contended by the examiner, so far.

Irrespective thereof, whether or not the cusp locus is smeared out around the z-axis and/or it indefinitely extends to $z\rightarrow\pm\infty$, it would be more persuasive if applicant could reconcile the inconsistency between the (z,θ_z,φ_z) geometry of applicant's disclosure (Fig.4) as opposed to the (x,θ_x,φ_x) geometry of the experiment, the latter being not by chance in agreement with the Cerenkov-like cone of a linear phased array under beam forming condition. It would be more persuasive if applicant would provide a complete diagram of the locus of the cusp similar to Fig.4 of the disclosure, but covering the distance range of the experiment, i.e., at least from 0 to 900 m. The diagram should

also simultaneously show, how this cusp locus relates with the geometry of the experiment shown in Figs.3-11 of Exhibit D (see Fig.3 and Fig.5B of this office action).

<u>43(e.4).</u> Fig.2 of this office action shows the succession of the wavefront envelopes as a Bolotovskii's point source moves along the curve S in applicant's Fig.1. These envelopes constitute a series of new, second order wavefronts for the propagation vector k of the emitted radiation from a curved array. Equivalent to the wavefronts of a steered beam, as previously described in a topological comparison, these curved envelopes or second order wavefronts represent either a converging (focused) or diverging (defocused) beam. As known form beam steering, curved wavefronts and converging or diverging beam does not need to be generated by a curved array. It can be as well simulated by applying appropriate time delays, as known in the pertinent art (see, e.g., [Somer], [Montebugnoli] and [Freq/Phase], as recited previously). Thus, applicant's curved envelopes are already <u>well known</u>, if not even <u>inherent</u> in the phased array technology. This provides a strong support for the examiner's view that applicant's experimental result, whether the array is curved or straight, is no other than the conventional beam steering effect.

As will be shown next, a good agreement between simple back-on-the-envelope estimates based on the beam steering effect with all aspects of applicant's experimental data provides a solid proof for the examiner's conclusion. Therefore, applicant's claimed invention is either anticipated or rendered obvious by phased arrays operating in the beam forming/steering/focusing mode, irrespective thereof, whether the examiner's doubt as expressed by points 43(e.1) to 43(e.4) is factually true or not.

43(f). <u>Beam Steering Angle θ</u>

Exactly in the same manner, a beam forming/steering can only occur if the interference condition is satisfied, i.e., a time delay Δt between successive array elements (spatially separated by $\Delta X=d$) is properly introduced, so as to make the apparent velocity $V_d=\Delta X/\Delta t=d/\Delta t$ becomes always larger than c (i.e., "superluminal"). The beam steering angle θ (see Fig. 1B) is then given by

$$\cos\theta = c/V_d \quad \text{...} \quad (1c)$$

To scan the whole angular range from $\theta=0^0$ to $\theta=90^0$ the phase "velocity" must be varied from $V_d=c$ ($\theta=0^0$) all the way through $V_d>c$ until $V_d=\infty$ ($\theta=90^0$). Such an <u>infinite</u> value of the "superluminal velocity" is one of the primary objections why the word "velocity" or "speed" is never used in the art jargon, besides that the latter is purely imaginative. Although applicant is normally allowed to be his own lexicographer (MPEP § 2111/III), there is a strong ground for objection against using this terminology throughout this patent examination. This will be discussed in section 8(f).

Rather than the imaginative term "superluminal velocity", the art jargon prefers to use the reality-based term "phase shift" as defined in Eq.1a, or a corresponding "time delay" given by

$$\Delta t = d\cdot\cos\theta/c \quad \text{...} \quad (1d)$$

The same beam forming/steering effect is clearly evident in applicant's experiment. If Δt is properly tuned, the array antenna will radiate in a certain direction, i.e., beam-steered, as vaguely perceived by applicant and indicated by the uncertain expression *"the cusp has a ... \`<u>beamed</u>' character"* recited in Exhibit A, on pg.13,

section C, lines 3-4. However, very much unlike true superluminal velocity of source distribution, applicant's antenna array keeps radiating, even if the phase velocity is "subluminal" (Fig.1A). The fact that applicant could still measure a signal although the imaginative phase velocity is only V_d=0.875·c is a solid evidence that applicant's radiation is completely conventional, whereas the apparent "non-spherically decaying component" is merely an inherent characteristics of a steered beam (Fig.1 B), as will be shown next.

43(g). <u>Rayleigh distance</u>

The examiner strongly disagrees with applicant's persistent claim that all interference effects, thus including beam steering, would vanish beyond the Rayleigh or Fresnel range. The fact is, beam steering by phased arrays is routinely implemented for distances far beyond the nominal Rayleigh or Fresnel range R_F, defined as

$$R_F = a^2/\lambda \quad \text{...} \quad (2)$$

where a is a linear dimension of the radiating area and λ is the radiation wavelength.

From an overwhelming number of factual evidences known in beam steering technology, we here take an example from Polishuk [Polishuk'2003]: The array dimension D is 2.5 mm and the wavelength λ is 1.55 μm. The nominal Rayleigh distance is thus $R_F = (2.5\cdot10^{-3})^2/1.55\cdot10^{-6} = 4$ m. However, Polishuk's device is designed for routine inter-satellite operation at 100 km (Table 2, pg. 2022).

Another example, now using RF dipole antenna radiating in the microwave frequency range, is taken from Benjamin (USPAT 5,969,661). About 100 array elements (=10x10) are used, each about the size of one wavelength, i.e., about 0.06 m

for a frequency of 4.8 GHz, as recited in Col.8/ll.44-52. Thus, the nominal Fresnel or Rayleigh distance, which determines the near-field zone according to applicant, is $R_F = (0.6)^2/0.06 = 6$ m, which again is very much shorter than the operating distance for which the array has been designed, i.e., for use in "free space over the horizon" (Benjamin, Col.3/ll.11-17).

As a matter of fact, beam steering devices using phased arrays in RF and optical communications, as well as high-energy laser weapons, are conventionally designed for long distances far beyond their corresponding Rayleigh range. An example of optical phased array transmitter for use in space communications is given in "Communications, Photonics and Lasers", <www.hrl.com/htm/cpl_main.html>. Another example of microwave phased array for communications with Low-Earth-Orbiting (LEO) satellites (R<1400 km) and Medium-Earth-Orbiting (MEO) satellites (R<36,000 km) is given by NASA in <www.grc.nasa.gov/WWW/RT1998/5000/5640anzic.html>; the LEO and MEO distances defined in <encyclopedia.thefreedictionary.com/Medium%earth%20orbit>.

Indeed, if the real world would follow applicant's claim that no interference effect could persist for distances longer than the Rayleigh distance, then none of those state-of-the-art devices would ever work! Contrary to applicant's, a correct interpretation is given by Hewish [Hewish'1996], stating that for an observation point at a distance larger than the Rayleigh range (Eq.2) *all* wavelets emitted by the entire radiating surface effectively contribute by way of interference to the intensity at that point. This interpretation also agrees with the Huygens-Fresnel diffraction theory, as recited in the website article [PH3310]<www.sun.rhbnc.ac.uk/~uhap045/331/notes15/notes15.html>,

pg.3/ll.1-6 from bottom. According to this general knowledge in the art, all beamlets coming from the entire source area a^2 effectively contribute to the interference at observation points located at distances larger than the Rayleigh distance R_F. If the source area would have been larger than a^2, there would be even more beamlets that would interfere at $R>R_F$. The interference persists and continues to $R \rightarrow \infty$, precisely in direct contradiction to applicant's interpretation.

In any case, since applicant's cusp is smeared out around the z-axis, and/or the radiation is distributed over a Cerenkov-like cone, the claimed radiation cannot be more efficient than a 2-dimensional phased array in which the radiation is concentrated into one pointed direction in space, let alone under focusing condition. With applicant's argument for dismissing any interference beyond the Rayleigh distance having been refuted, theoretically as well as by factual evidence, one of ordinary skill in the art may thus conclude, applicant's claimed invention must be (much) less effective than a conventional phased array. Therefore, it would be more persuasive to provide a hard evidence in the form of antenna gain (see sub-paragraph 43(n) item (b)).

It is generally known in optical communications that phased array radiation can be simply derived from a single laser beam, whereby the phase shift or time delay is accomplished by using phase delay elements to establish the necessary beam forming condition $\Delta\Phi=(d/\lambda)\cdot 2\pi\cdot\sin\theta_0=2\pi\cdot(d/\lambda)\cdot\cos\theta$ (Eq.1a), or by true time delay Δt to establish $\Delta t=(d/c)\cdot\cos\theta$ (Eq.1b), in order to steer the beam into an angle θ. It is also well understood in the art that an array of laser diodes radiating in synchronized phases would also perform the same, as recited by Mohr et al. in col.1/ll.19-32. In this regard, it

does not make any <u>effective difference</u> whether the time delay is implemented by a phase-shifting material having controllable dielectric constant, as recited by Mohr et al. in col.1/ll.23-27, by Geyh et al. (USPAT 6,184,832), col.4/ll.1-8, and by Phelan (USPAT6,611,230) as recited in col.3/ll.63-68 and col.4/ll.1-7 & 52-60, or it is introduced by an electronic time delay circuit as part of individual antenna feed, as in Exhibit A, or in Sanford et al. (USPAT 5,243,358), as shown in Fig.3 by the phase shifter 17 connected to each amplifier 16, recited in Col.6/ll.14-17. The equivalence of these alternative methods for beam forming/steering is described by Anderson et al. in Appl. Opt. 41(23), 2002, pp.4912-4921, hereinafter [Anderson'2002], or in Anderson <www.ece.osu.edu/~anderson./original.pdf> in case of optical phased array, and by C. Schreiner <<u>www.red-river.com/Publications/Schreiner</u>> as well as by Cherrette (USPAT 5,293,171), as recited in col.2/ll.45-67, in case of RF antenna array.

This equivalency clearly shows that there is no true "superluminal" motion necessary (in contradiction to applicant's claim), and further, that such "superluminality" is only a product of fantasy or imagination. In particular, the wording "*<u>accelerated</u> through the light velocity in vacuo*" was never taught by Bolotovskii et al.. Therefore the word "superluminal", let alone "*<u>accelerated</u> through the light velocity in vacuo*" should never be used in technical and scientific articles, since it does not contribute to the understanding of the subject matter, if not even misleading.

43(h). <u>Non-spherically decaying radiation component</u>

Obviously, applicant's reference to "non-spherically decaying component' in relation to Rayleigh range as a threshold between near-field and far-field regimes is

incorrect and has to be revised, as expressed by J. Hannay cited in [PhysicsWeb'2004] (last sentence), and by A. Hewish, cited in Science Vol.301, No. 5639, 09/2003, pp.1463-1465 (hereinafter [Science'2003]), both reciting that a range of 10-80 km is more likely needed to test the $\sim 1/R^2$ intensity decay, instead of a mere 900 m range measured in applicant's experiment. Indeed, cylindrical waves radiated by line arrays are known in the art to decay non-spherically in the near field (Murray, "Understanding Line Array Systems", pg. 1 "Cylindrical Waveform" and pg.2 "Critical Distance").

Another important remark is made by Hewish in [Hewish'1996] on pg.L28, col.1, lines1-20, in reference to Fig.1(a), reciting that radiation from a linear phased array has a $\sim 1/R$ intensity dependence, since the length Δz of the antenna segment that contributes to the cusp wave front increases with the radius R of the wave front,

$$\Delta z=\sqrt{(R\lambda)}/\sin\theta \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

which is closely related to the Rayleigh or Fresnel formula in Eq.2 (see also previous citation from [PH3310]).

All these factual evidences indicate that a linear array (similarly, a cylindrical antenna array) may achieve their effective far-field (characterized by the inverse square law intensity dependence) far beyond their nominal Rayleigh distance, meaning that a $\sim 1/R^x$ intensity dependence with $x<2$ may well be <u>inherent</u> to <u>linear phased arrays</u> (not necessarily curved or circular/cylindrical) at least over many multiples of R_F. Hewish's remark [Hewish'1996] with regard to Fig.1(a) further suggests that radiation from an <u>infinitely long</u> linear phased array (as presumed in the theoretical part of applicant's disclosure) inherently would defy the inverse square law. Rigorously, the inverse

square law starts to apply, if the radiation source can be regarded as a point source when viewed over a distance R. This is a well known fact in the field of RF and optical communications, as implicated by a transmitter antenna gain G that is a constant, independent of range R in the far field (i.e., interplanetary distances; see, e.g., SPIE Opt. Eng. 42(11), 2003, pp.3139-3157 [Souw 2003], Appendix F, Eqs.43-45, pg. 3153).

Being linear and one-dimensional, applicant's array is in fact an *inherent part* of the conventional two-dimensional array (Fig.5A). The fact that applicant's array is open on two sides (Exhibit D, Fig.1(e) on pg.3 and pg.4/ll.10-12), only means that applicant's array is quite "lossy", for having to distribute the radiated power into multiple directions (2 main lobes + additional side-lobes), instead of only one single direction as in a conventional phased array. This is easily seen by comparing a conventional two-dimensional phased array in Fig.5A with a one-dimensional (linear) array in Fig.5B. Since there is only one single array excited by only one "superluminal velocity", applicant's beam steering angle is the same for both angular deflection θ and φ, thus resulting in Cerenkov-like cone with apex angles varying between $\theta \approx 20^0$ to 60^0, but inhomogeneously distributed over the cone surface, as tentatively illustrated in Fig.5B. In comparison to the 2-dimensional array in Fig.5A, applicant's radiation power or intensity is thus much lower, for having to distribute over the surface of the Cerenkov-like cone. This is one possible origin for the non-spherically decaying component observed in applicant's radiation shown in Fig.11(a,b) of Exhibit D. Thus, the measured property is much more likely to be a *disadvantage*, if compared to a conventional phased array, rather than an advantage, as claimed.

43(i). <u>Differences in Geometrical Array Design</u>

Irrespective thereof, whether or not applicant's experimental array is properly designed with regard to impedance matching and antenna resonance, its geometry is still part of (and hence, inherent to) a conventional 2-dimensional phased array known in the art as <u>patch antenna</u>. As known in the art, the patch antenna design is increasingly popular as a compact version of dipole antenna phased array having a substantially flat overall design (e.g., 3"x3"x0.5" as disclosed by Weinberg et al. in USPAT 5,572,216 col.11/ll.19-23). The steerable beam is emitted into the half space facing the flat antenna surface, as described by Nielsen in USPAT 6,281,839, as shown in Fig. 4 & 5 recited in Col.9/ll.1-3 and in Fig.12 recited in col.13/ll.32-40. Similar to applicant's experimental array, the patch antenna comprises an array of patch electrodes on top of a dielectric panel, as described in USPAT 5,202,752 issued to Honjo. Similar to applicant's capacitive array, the distance between the top and the bottom electrodes is a fraction of the wavelength, as described in sect.[0014] of US Pat. Pub. 2004/0008140 issued to Sengupta et al. (Note, this particular condition gives rise to a screening effect that renders the second lobe of cusps/wavefronts shown in Fig.1 and 3 of the disclosure hardly possible to form). Similar to applicant's, the patch electrodes may be excited by individual amplifiers having electronically active time delays, instead of by passive phase shifters, as described by Cherrette, USPAT 5,293,171, col.2/ll.49-67. Patch antenna may be used as alternative to dipole half-wave antenna, as disclosed by Katz et al. USPAT 6,321,066 in reference to Fig.2, recited in col.6/ll.51-61, and by Engelbrecht et al. in reference to Fig.9, recited in col.9/ll.62-67.

Owing to this equivalence, in this office action reference will be made to either dipole phased array antenna or patch antenna array without discriminating their different designs.

To shape applicant's experimental antenna starting from a patch antenna, the additional dimension (i.e., column X or row Y) that is not needed for applicant's design may be simply omitted, either by applying a zero time (or phase) delay along the undesired row (or column), or by de-activating the columns or rows that are not needed (see e.g. Erlick et al. USPAT 5,969,675, col.5/ll.57-58, col.5/ll.66-67 and col.6/line 1 + ll.35-42), or by cutting-off the redundant parts of the 2-dimensional array, the latter leaving the array along the cut side open, thus enabling the radiation to leak out. Regarded as linear array, applicant's experimental array is thus imperfect, or non-ideal, or irregular, for having unsymmetrical conditions for the X and Y directions.

Compared to the conventional 2-dimensional array of Fig.5A, which emits a steered beam in a definite direction represented by the vector ***k***, the beam of applicant's linear array is distributed over the surface of a Cerenkov-like cone with apex angle θ determined by Eq,1c. The non-ideal geometry of applicant's array, mainly characterized by an unsymmetrical design in the X and Y direction, will only cause some minor modification to the cone apex angle θ and/or distortion of the cone surface distribution of the beamlets shown in Fig.5B. Specifically, because the bottom part of the array is fully obstructed by the electrode, the lower half of the cone is expected to be severely distorted and attenuated. Partially obstructed are also parts of the top.

Despite those minor modifications and distortions already expected, it is not at all surprising that applicant's angular locus of the radiation peak as recited in Exhibit D, pg.10/sect.IV-A/ll.9-11, i.e., $\theta_H \approx 20^0$ for $V_d=1.06 \cdot c$, is the same as the result from beam steering formula, Eq.1c, which gives a beam steering angle of $\theta=19.7^0$ for an ideal straight linear array. Further results shown in Fig.5(a,b), Exhibit D, for $V_d=1.25 \cdot c$ and $V_d=2.0 \cdot c$, also show good agreements with conventional beam steering (Eq.1(c)), the latter resulting in a beam steering angle of $\cos^{-1}(c/V_d)=36.9^0$ and 60.0^0, respectively, in the ideal case. The existence of side lobes in most of those experimental data can here be qualitatively explained as being a result from an inhomogeneous distribution of the beamlets over a Cerenkov-like cone, as illustrated in Fig.5B, the figure also showing how applicant's observation angles θ_H, Φ_H, θ_V and Φ_V, relates to the cone geometry. A slightly larger disagreement found for $V_d=1.25 \cdot c$ may arise from data inaccuracy and/or from the non-ideal geometry of applicant's array, as stated previously. Furthermore, ground reflections may also complicate the observation through interference effects and undesired side lobes. Similar back-of-the-envelope estimates based on the simplified straight linear array further show fairly good agreements with Exhibit D, Fig. 6(a,b), Fig.8, Fig.,9 etc ..., where some mismatches may have their origin in applicant's non-ideal geometry, including the 10^0 curvature (all the mismatches are within 5^0-10^0 of the array curvature).

Shift of the f+ and f- propagation direction

A shift of the beam-steering angle due to the 46 MHz modulation, as shown in Exhibit D, Fig.6(a,b) and recited in Exhibit D, pg.7/ll.8-11 from bottom, is as predictable

as also inherent in conventional beam steering by a straight linear array. Physically, the beam steering angle is directly determined by the phase shift defined in Eq.1a, which gives the shift of the steering angle θ_v for the f+ and f- components as shown in Fig.6, originating from a difference in the wavelength $\lambda+=c/f+$ and $\lambda-=c/f-$. As illustrated in Fig.6, the f+ and f- components of a modulated carrier frequency f_0, irrespective thereof whether or not the carrier frequency is suppressed, travels with their respective phases progressively phasing-in and phasing-out to combine into a modulation waveform shown by Ghassemlooy, slide #5. The envelope formed by the intersecting wavefronts of each frequency component has its phase shifted by $\delta(\Delta\Phi)$ according to Eq.1a due to a wavelength difference $\delta\lambda$,

$$\delta(\Delta\Phi)/\Delta\Phi = -\delta\lambda/\lambda - \tan\theta\cdot\delta\theta \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

For the f+ and f- components, this results in two propagation directions ***k+*** and ***k-*** that slightly differ from the propagation direction of the carrier frequency $\boldsymbol{k_0}$ by $\delta\theta$. Since the cusp for each of each frequency component is defined by equal phase ($\delta(\Delta\Phi)=0$) in the adjacent wavelets radiated from each of the array element (see Fig.6 and Fig.1B), the difference in steering angle $\delta\theta$ is given by the condition $\delta(\Delta\Phi)/\Delta\Phi = 0$ in Eq.4, i.e.,

$$\delta\theta = - = -(\delta\lambda/\lambda)\cdot\cot\theta \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

Calculating $\delta\theta$ according to Eq.5 using applicant's experimental data, we obtain for $V_d=1.25\cdot c$ a shift of beam steering angle (with respect to that of the carrier frequency) to $\theta_v=42.4^0$ and 30^0 for the f+ and f- component, respectively, whereas for $V_d=2.0\cdot c$ the beam steering angle shifts to 62.5^0 and 42.4^0, respectively. These values agree both in magnitude and sign with the θ_v shifts observed for $V_d=1.25\cdot c$, as shown in Fig.6(a), i.e.,

44^0 and 39^0, respectively, and for V_d=2.0·c, as shown in Fig.6(b), i.e., 65^0 and 57^0, respectively. As before, numerical mismatches are due to data inaccuracy and/or non-ideal geometry of applicant's array, as they all lie within the 5^0-10^0 array curvature.

Again, no array curvature has been assumed in making the predictions. These good agreements with applicant's various experimental results provide altogether a solid evidence that applicant's invention is nothing else than conventional beam steering, in which no superluminal speed, no acceleration through the speed of light in vacuo, no array curvature, and no modulation are involved, or needed. This is further supported by the fact that the experimental geometry agrees with the Cerenkov-like radiation cone of a linear phased array, i.e., expressible in (x,θ_x,φ_x) coordinates with x being on the plane of the array, as opposed to the cusp geometry (z,θ_z,φ_z) shown in Fig.4 of the disclosure, where z is an axis perpendicular to the plane of the array.

43 (j). <u>Array Curvature and Non-Spherical Decay</u>

(a) Figs.11(a) to (d) do not really show the claimed decay behavior because of several aspects. The first aspect is, the ratio P_{cusp}/P_{sub} as shown are all less than unity, which also means that the ratio may well approach, but does not need to exceed unity for larger values of R. As known in the art, this is a typical near-field behavior, in which a constant value of the ratio (representing a spherical decay) is approached asymptotically. The fact that P_{cusp}/P_{sub} <1 in Fig.11(a)-(d) only means that the radiation power, P_{cusp}, is always smaller than that of a conventional spherical decay, P_{sub}, such that a claim of any advantage is groundless. The fact that no more than only one <u>single</u>

data point in Fig.11(a) among many hundreds of others, moreover lying well within the statistical scatter of the data, should not be used by anyone of ordinary skill in the art as a credible excuse to justify that P_{cusp}/P_{sub} tends to exceed unity for R values larger than 800m. Especially not, when the condition $P_{cusp}/P_{sub} > 1$ would inherently mean a violation of the energy conservation law, as will be explained in the following.

The large discrepancy in the absolute data value (showing less than 0.3 in Figs.11(b) to (d), as opposed to the data points of Fig.11(a)), indicate that the measurement were not made under a consistent signal detection condition, i.e., the detector current ratio $i_{cusp}/i_{sub} \sim (\beta1 \cdot I_{cusp})/(\beta2 \cdot I_{sub}) = (\alpha1 \cdot P_{cusp})/(\alpha2 \cdot P_{sub})$ were not taken under the same condition ($\alpha1 \neq \alpha2$ and/or $\beta1 \neq \beta2$) from one series of measurements to the other. As known in the art, this does not really matter, since only the fact that $P_{cusp}/P_{sub} \rightarrow$ constant should be taken as a criterion for a spherical decay behavior. However, in the event that applicant would claim that the ratio P_{cusp}/P_{sub} measured in applicant's experiment actually exceeds unity, the claim must be deemed incredible, since it inevitably violates the energy conservation law. For P_{cusp}/P_{sub} to really exceed unity, the signal intensity I_{cusp} must be mathematically expressible in the form

$$I_{cusp} \sim a/R^2 + b/R + \ldots \tag{6}$$

that is valid for all range of R up to infinity, and not just within a limited range conventionally defined as "near field" zone. Unless the observation angle θ is decreasing with R (as stated previously in 43(e.2) with regard to a smearing-out of the cusp locus), one of ordinary skill in the art may express the total signal power as an

integral over the entire beam cross section A (see Fig.4, with the X-axis redefined as R and the radius R redefined as $R' = R/\cos\theta$)

$$P_{cusp} = \int I_{cusp}\, dA = (b/R)\, dA + \ldots$$

$$= \int (b/R)\cdot 2\pi R^2 (\tan\theta/\cos\theta) d\theta + \ldots\ldots$$

$$\geq 2\pi b\cdot R\cdot \int(\tan\theta/\cos\theta)d\theta + \ldots. = (2\pi b/3)\cdot[1-\cos^3\theta_0]\cdot R \ldots\ldots\ldots\ldots\ldots \quad (7)$$

Obviously, with increasing distance R the expression of Eq.(7) would increase without bound, and hence, --beginning with a certain value of R-- would inevitably exceed any given power input, thus violating the energy conservation law. Therefore, a power dependence as in Eq.6 can only be valid within a certain limited range conventionally called the "near field" zone. This near field zone needs not to follow applicant's definition regarding the Rayleigh distance, which has been previously proven as incorrect (sub-paragraph 43(g)). To be rigorous, Figs.11(a)-(d) do not exclude the possibility that further measurements would show saturation to a constant value (spherical decay) beyond the 900m distance covered in the experiment. In fact, Fig.11(a) even appears to show a trend of saturation towards the end of the 500-600m plot range. In any case, applicant's interpretation as expressed in Eq.6 not only has no evidence, but also has been proven as violating the energy conservation law, and hence, must be deemed incredible. Non-spherical decay is only credible/possible within a limited range; this limited range determines the effective "near field" not always given by the Fresnel or Rayleigh distance z_R as defined in Eq.2.

As previously described, laser radiation decays in the "far field" spherically, only if the distance is measured from the beam waist (see Eq.3 in [Melles'Griot]). However, if

the distance is measured from the collimating optics, the intensity decay behavior is non-spherical (~$1/r^x$ with $x<2$) up to (many) multiples of the Rayleigh range. The effect is more pronounced if the beam is focused. As described previously, such a non-spherical decay behavior is indicated in a figure on pg.5 of [Melles'Griot] for focal lengths up to 4 times the Fresnel or Rayleigh distance z_R, which practically extends to much larger multiples of z_R, since there is no theoretical limit for the z_R/f ratio that dictates such a behavior (but only practical limit). In view that non-spherical decay behavior is shared by many conventional beams resulting from collective interference, such as laser beams, the bottom line is NOT that applicant's phased array is capable of showing non-spherical decay for a limited range (<900m), but rather, that conventional phased arrays would show a strictly spherical decay behavior. As an experimental "evidence" it would have been more persuasive if applicant would be have shown: (a) non-spherical decay behavior up to $z \rightarrow \infty$, or at least up to z=10-80 km, as suggested by Hannay [PhysicsWeb'2004] and Hewish [Science'200]; and (b) an antenna gain G>1 over the cited distance ranges. Obviously, applicant's experimental data failed to demonstrate any of those crucial criteria.

(b) A curved array emits a curved cusp(s) or beam wavefront(s), which results in either a focused or a defocused beam, as described previously. However, there is no compelling reason or necessity to make the array physically curved as in applicant's device. As stated previously, curved wavefronts can be electronically simulated by applying additional phase shifts or time delays to the respective array elements, with the beam steering angle appropriately accommodated by any mirror design of choice

One of ordinary skill in the art would therefore conclude, the non-spherically decaying behavior measured in applicant's experiment may be inherent to a phased array in the focusing mode that is either physically or electronically "curved". However, the non-spherical decay would only persist for a certain range of R (near field), and --most importantly-- the radiation efficiency is inferior (i.e., of lower power or intensity) as compared to a conventional radiation system obeying the inverse square law. This is in direct contradiction to applicant's statement in the specification, pg.32, section C, lines 5-6. As previously discussed in reference to Fig.5A and 5B, such an inferior radiation efficiency is very well plausible and likely.

Nevertheless, applicant's open-top device does not distinguish from, but is in fact a part of, and hence, *inherent* to, or at least obvious over, a conventional 2-dimensional phased array. The patch antenna design also has a contiguous dielectric material which is partially open at the top, as shown by Nielsen in Fig.4 and 5, by Sengupta et al. in Fig.2, by Honjo in Fig.3, by Geyh et al. in Fig.2 & 2A, and by Phelan in Fig.3. Since Applicant's device is obviously inherent to a conventional phased array, the latter is inherently capable of reproducing applicant's claimed effects, e.g., by using only one single row or column of the array, while inactivating all the others. Such an inherent capability inevitably reduces the antenna gain, as recited by Erlick (USPAT 5,969,675) in col.5/ll.57- 58, col.5/ll.66-67 and col.6/line 1 and lines 35-42. Although the peculiar array design produces a peculiar radiation pattern that is neither anticipated nor rendered obvious by any prior art, the inherently-inferior efficiency revokes every claim of well-established utility from the invention.

The reasons set forth in (a) and (b) above are not the only cause for the non-spherical decay behavior measured in applicant's experiment. Even so, based on those facts alone, applicant's claim that the measured non-spherically decay has no range limitation and is exclusively caused by the curved array of unique design under specific excitation and modulation, has no factual basis, whatsoever, but is much more likely to be incredible, or speculation at best. At most, one of ordinary skill in the art would rather conclude, applicant's unique design produces some minor and insignificant modification and/or distortion in the steered beam profile and its radiation pattern, but is accompanied by a significant loss in antenna gain, which is evident from the measured values of $P_{cusp}/P_{sub}<1$ in Exhibit D.

Applicant's "evidence" would have been more persuasive if applicant could provide hard evidence of higher antenna gain for distances >>900m. This is because any claim of "better", "more efficient", or "more economical" type of radiation (generator) is factually groundless, unless one can provide hard evidence for an antenna gain substantially higher than conventional. For applicant's reference, conventional 2-dimensional phased arrays have antenna gains up to 50 dB in the far field (see Johnson et al., USPAT 6,088,002, col.6/ll.4-9 and Lovberg et al., USPAT 6,556,836 claims 4, 9 and 10); state-of-the-art phased arrays even up to 100 dB gain (Anagnos, US Pat. Pub. 2004/0152415, sect.[0044]).

43(k). Suggestions to remove incredible statements from the disclosure

The examiner suggests to omit a number of statements from the specification in order to overcome the applied §101 rejection based on incredible and/or inoperative

disclosure, in addition to eliminating all phrases using the wording "superluminal". These statements include, but not only restricted to:

(a) "... significant commercial values", recited on page 1, paragraph 5/lines 2-3;

(b) "... enable the employment of lower power transmitters and/or larger transmission ranges", recited on lines 3-4 of the same paragraph;

(c) "... generates focused pulses that not only are stronger in the far field than any previously studied class of signals ..", recited on pg.32, section C, lines 5-6;

(d) "Thus the power required to send a radio signal from the Earth to the Moon by the present transmitter would be 100 million times smaller than that which is needed in the case of conventional antenna", recited on page 32, section C, 2nd paragraph, lines 6-9;

(e) In addition, I would be advisable to omit the recitation on pg.32 section C, lines 1-6, because it is simply untrue: "*There are <u>at present no known antennas</u> .... has the time dependence of a <u>traveling wave</u> with an accelerated superluminal motion. A <u>traveling wave antenna</u> of this type ....*" It is to be known that such a traveling wave antenna is conventional and has been known since many years, as recited by Lovberg et al. (USPAT 6,556,836) in col.8/ll.1-6, with the wording "traveling wave antenna" expressly recited in line 4, while referring to an original patent issued to Phillips et al. (USPAT 6,037,908).

43(l). <u>Regarding Applicant's "acceleration to superluminal" velocity</u>

As known in the pertinent art, scanning the angle θ is accomplished by changing the delay time Δt, as recited by [Somer] in reference to the figure on pg.5; by [Montebugnoli] in reference to the figure on pg.2 and recited in lines 1-5 on the same

page; and in the previously cited [Freq/Phase], in reference to Fig.3 on pg.3. In term of applicant's language, the imaginative velocity V_d should thus be changed from one "superluminal" value to another "superluminal" value, i.e., per definition, "*accelerated*". Based on this timely change of some "velocity", one having an imaginative thinking would say, the "*distribution has an accelerated motion with superluminal speed*", as recited in claim 21, or "*accelerate the current or charge distribution through the speed of light in vacuo*", as recited in claim 23.

Another virtual "*acceleration*" of charge distribution (pattern) can be associated with focusing a steered beam, here accomplished by applying successively different delay times to successive array elements, as described by (a) J. Somer et al. in reference to the same previously cited figure on pg.5; and (b) Deutsch et al. in "Defect Detection with Rayleigh and Lamb Waves Generated by Self-Focusing Phased Array", in reference to Fig. 1 on page 2. A live demo in real-time of such scanning and focusing by phased arrays is given in [Phased Array Principle], as already cited in previous section 27. Already misled by the fictive velocity V_d, one having excessive imagination might attempt to further stretch-out Bolotovskii's "superluminal" radiation beyond physical reality by making a statement like "*the charge or current distribution is accelerated through the speed of light in vacuo*".

Obviously, the conventional technique of beam steering and beam focusing with phased arrays has been misconstrued by applicant by imagining it as a "*motion*" that is "*accelerated to superluminal speed*", where in reality there is no motion whatsoever.

43(m). Conclusions

In conclusion, applicant's experimental results has failed to bring the application to the condition of allowance, because the demonstrated results do not show what applicant has specifically claimed, as described above. To summarize the facts, applicant's claimed result is produced by a linear (one dimensional) phased array in beam forming/steering mode without any need of all the "novel" features claimed by applicant, i.e., (1) no "superluminal motion" and no "acceleration" to "superluminal speed", but merely by virtue of conventional beam steering operating condition; (2) no curvature of the linear array, a straight linear array will do the same; (3) no modulation, a conventional excitation using one single carrier frequency with proper phase shift or time delay is sufficient; and (4) no spatial distribution of charge or current density, a spatially homogeneous excitation by a single carrier frequency is sufficient, as long as the phase delay is appropriate. Furthermore, applicant's non-spherically decaying radiation behavior is not an advantage as claimed, but a <u>disadvantage</u> for being <u>inferior</u> in radiation intensity and antenna gain as compared to a conventional radiation that obeys the inverse square law, e.g., a 2-dimensionally steered beam from conventional phased array, or a simple focused laser beam (Eq.6a,b).

This conclusion is not new at all, but is substantially coherent with the objections raised in the previous office action, thus reinstating and reinforcing the previously applied §101 and §112/¶.1 claim rejections based on an incredible invention. These rejections have not been based on an absence of asserted utility, as alleged by applicant in the 05/17/2004 Response (pg.13, section B. "The claimed invention is useful"), but instead, because the asserted utility has been

(and is) deemed misleading and incredible in the light of knowledge in the art, or "speculative" at best.

> MPEP §2017.01/II *(underlines added by the examiner): "the Office considered the asserted utility to be inconsistent with known scientific principles or "speculative at best" as to whether attributes of the invention necessary to impart the asserted utility were actually present in the invention. In re Sichert, 566 F.2d 1154, 196 USPQ 209 (CCPA 1977)."*

Examples of specific attributes that are not actually present are, e.g., "superluminal source", "superluminally accelerated source", "superluminally accelerated source distribution", "accelerated through the speed of light in vacuo", and the likes, because they are neither actually present nor needed, and further, a *"non-spherical decay"* or *"slower-than-1/R^2 decay"* of the signal intensity claimed to be specifically caused by the curved array and the specific modulation implemented in applicant's experiment, because the examiner's back-of-the-envelope calculations (in compliance with 37 CFR §1.104(c)(3)) has shown that such a non-spherical decay behavior is completely within expectation of (i.e., inherent to) a conventional linear array, without any need for array curvature and DSB/SC modulation, albeit for a limited range only. Further claimed attributes not actually present include the alleged advantage of having a non-spherically decaying component, as recited in sub-paragraph 43(j), (a) to (d).

All these evidences prove that applicant's claimed invention is inconsistent with the known scientific principles. In particular, applicant's basis for the experiment as supported by Exhibits A and D, i.e., a curved antenna array and a spatial and/or amplitude modulation of the carrier, have been proven as being inoperative for producing the claimed results, because the claimed results have been evidently

produced by a fully different but fully conventional means <u>not claimed</u> by applicant. MPEP § 2107.01/11 states that an invention is "*<u>inoperative</u>*" if it does not operate to produce the results claimed by the patent applicant. *Even worse, those conventional means has been <u>disclaimed</u> by applicant as being <u>incapable</u> of generating the claimed results.* The latter is reflected in claim 57 disclaiming phased array beam forming.

This conclusion is in agreement with a number of other authors from the scientific community, even including those which have been called by the applicant to his own support, while being also solidly supported by the general knowledge in the pertinent arts, such as beam forming & beam steering, phased array antenna, RF and optical communications, and ultrasound technology. Beyond the previously cited criticism launched by the scientific community so far (PhysicsWeb'2000), the present office action has logically and scientifically pointed out where exactly applicant may have misconstrued the physics underlying the invention.

43(n). <u>MPEP paragraphs regarding Hard Evidence</u>

Under the above circumstances, hard evidence would be necessary to validate and justify the specific asserted utility claimed by applicant's invention in accordance with MPEP § 2107.02/III:

> *As a matter of Patent Office practice, a specification which contains a disclosure of utility which corresponds in scope to the subject matter sought to be patented must be taken as sufficient to satisfy the utility requirement of § 101 for the entire claimed subject matter <u>unless there is a reason for one skilled in the art to question the objective truth of the statement of utility or its</u> scope. In re Langer, 503 F.2d at 1391, 183 USPQ at 297 (emphasis in original).*
>
> *In In re Brana, 51 F.3d 1560, 34 USPQ2d 1436 (Fed. Cir. 1995), the Federal Circuit explicitly adopted the Court of Customs and Patent *>Appeals'< formulation of the*

> *"Langer" standard for 35 U. S. C. 112, first paragraph rejections, as it was expressed in a slightly reworded format in In re Marzocchi, 439 F.2d 220, 223, 169 USPQ 367, 369 (CCPA 1971), namely:*
>
> *[A] specification disclosure which contains a teaching of the manner and process of making and using the invention in terms which correspond in scope to those used in describing and defining the subject matter sought to be patented must be taken as in compliance with the enabling requirement of the first paragraph of § 112 unless there is reason to doubt the objective truth of the statements contained therein which must be relied o -for enabling support. (emphasis added).*

Since a *prima facie* case has been established regarding applicant's new evidence, and furthermore, applicant has failed to rebut the *prima facie showing* made in the previous office action, i.e., in accordance with

> MPEP §2107.02/VI: *"If a rejection under 35 US. C. 101 has been properly imposed, along with a corresponding rejection under 35 US.C 112, first paragraph, the burden shifts to the applicant to rebut the prima facie showing. In re Oetiker, 977 F.2d 1443, 1445, 24, USPQ2d 1443, 1444 (Fed. Cir. 1992) ("The examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a prima facie case of unpatentability. If that burden is met, the burden of coming forward with evidence or argument shifts to the applicant ....'),*

it is considered necessary to implement the following MPEP rule

> *MPEP §2107.02/V: "In appropriate situations the Office may require an applicant to substantiate an asserted utility for a claimed invention. See In re Pottier, 376 F.2d 328, 330, 153 USPQ 407, 408 (CCPA 1967) ("When the operativeness of any process would be deemed unlikely by one of ordinary skill in the art, it is not improper for the examiner to call for evidence of operativeness."). See also In re Jolles, 628 F. 2d 1322, 1327, 206 USPQ 885, 890 (CCPA 1980); In re Citron, 325 F.2d 248, 139 USPQ 516 (CCPA 1963); In re Novak, 306 F.2d 924, 928, 134 USPQ 335, 337 (CCPA1962). In In re Citron, the court held that when an "alleged utility appears to be incredible in the light of the knowledge of the art, or factually misleading, applicant must establish the asserted utility by acceptable proof." 325 F.2d at 253, 139 USPQ at 520".*

The following hard evidence would be needed to validate and justify the asserted utility:

(a) Regarding the 46 MHz modulation and the 10^0 curvature in applicant's antenna array, factual evidence would be necessary to show that a straight linear array excited by only one single carrier frequency, without any modulation or any other form of "*spatial distribution of the source*", but still fulfilling the conventional condition for beam forming & beam steering regarding the phase shift or time delay applied to the elements of the array, would not show a similar non-spherically decay behavior as shown in applicant's Exhibit A.

Note: *This is not because the examiner contends the experiment is faulty. In the contrary, the demonstrated agreement between the examiner's back-of-the-envelope estimates based on a straight linear antenna without modulation clearly shows that the experimental results are very well plausible. However, there is no evidence whatsoever that the measured non-spherical decay is exclusively due to the applicant's unique apparatus design and method, as claimed. On the other hand, plentiful evidence and indications strongly point out that the non-spherical decay behavior is inherent to linear arrays and beam steering, specifically without curvature, without modulation, without "superluminal" motion, and without "acceleration through the light velocity in vacuo". The array curvature only produces some minor modifications that can be understood and predicted by conventional means well known in the art. Therefore, to rebut this prima facie showing, hard evidence would be necessary to prove that the claimed characteristics are indeed specifically and exclusively attributed to applicant's invention.*

(b) To prove the claimed existence of a (line) "cusp" with all its advantages, and to avoid the necessity of omitting from the disclosure the statements (a) to (d) discussed in sub-paragraph 43(k) above, hard (quantitative) evidence would be necessary to prove that applicant's invented device is indeed capable of delivering signal powers or intensities

substantially higher than a conventional phased array operated under beam forming/steering mode with the same input power. Such a hard evidence would be, e.g., an experimental measurement of the antenna gain in the far field (>> 900 m).

(c) Hard evidence would be necessary to reconcile both the minor and major discrepancies identified in sub-paragraph 43(e) between the geometry of applicant's disclosure (Fig.4) as opposed to the geometry of the experiment, and provide a complete diagram of the locus of the cusp similar to Fig.4 of the disclosure, but covering the distance range of the experiment, i.e., at least from 0 to 900 m. The necessary diagram should simultaneously also show how this cusp locus relates with the geometry of the experiment shown in Figs.3-11 of Exhibit D (see Fig.3 of this office action). In case the cusp locus is not smeared out, it would be necessary to explain, why it is not smeared out despite the rotation-symmetric traveling wave used in the experiment, and specify the unique value of φ^ in the experiment, complete with a persuasive reasoning.

Note: *The problem regarding the inconsistencies addressed in (b) and (c) above is much more serious than it appears. The Cerenkov-like cone of radiation emitted by a circular or curved array depicted in Fig.4 of the disclosure is tangential to the circle (see Fig.3), so that very little radiation --if at all-- will be found at the location of the cusp. If this was the reason why the experiment was conducted in the x-direction instead of the z-direction dictated by the disclosure, then the disclosure would have to be drastically revised to comply with the factual evidence. However, such a revision would be interpreted as an introduction of New Matter into the disclosure.*

(d) It would be more persuasive to provide a full frequency spectrum covering a region from 46 MHz to 598.7 MHz on a scale that allows intensity comparisons, one for the

experimental curved array, and another one for a straight array. This proof is to show that applicant's experimental result (as claimed) were indeed distinguished in terms of higher frequency components from what is already expected by one of ordinary skill in the art based on a conventional DSB/SC excitation of a straight RF antenna array (Fourier analysis). Such a proof would also serve as verification for the radiation spectrum as claimed in the disclosure, i.e., in J. Opt. Soc. Am. A20 (11), 2003 (Exhibit B) in reference to Figs.6-9, and in J. Opt. Soc. Am. A21 (5), 2004 (Exhibit C), in reference to pg. 13/lines 24-26, i.e., supposedly a result of the "*rotation of polarization current*", as claimed in Exhibit D/Eq.36 & Eq.2 (Table 1), Exhibit B/Eq.7 and Exhibit C/Eq.9a.

EXAMINER'S RESPONSE TO THE DECLARATION UNDER 37 CFR:1.132

44. Dr. Rickel's affidavit has totally missed the point of the examiner's rejection. The following is the examiner's response:

Affidavit:

1. Dr. Dwight Rickel, hereby declare that:
I have been an applied physicist for the past 35 years and have considerable knowledge and experience in electromagnetics and propagation phenomenon. Specifically, I spent two years measuring electromagnetic emissions from relativistic electron beams propagating in air where ground reflections and antenna calibrations were of considerable importance. I was also involved in wideband antenna development and ionospheric propagation.

2. Since 1980, I have worked at Los Alamos National Laboratory (Footnote [1]: This is my personal declaration and does not represent any official involvement of the Los Alamos National Laboratory) in areas related to nuclear physics. In 1991, I was the project leader that built the National High Magnetic Field Laboratory at Los Alamos. Since 1991, I have worked as a staff scientist in the National High Magnetic Field Laboratory. Prior to working at Los Alamos National Laboratory, I worked at a company called EE&G in ionospheric physics and RF propagation and at Northrup Services working on long path monitoring for lasers. I received my

Masters of Science (nuclear physics) in 1971 and a Ph.D. (nuclear physics) in 1973 from the University of Arizona. I was a post doctoral fellow at Duke University for approximately two years in nuclear physics.

Examiner's Response to (1) & (2):

The affiant's professional credentials is appreciated. However, it is to be emphasized that affiant's title and experience does not play any role in a patent examination, but his affidavit per se will be evaluated based on the merit; in particular, its technical content and scientific credibility (see previously cited MPEP § 716.01(c)). Similar appreciation is also given to the affiant's present and past position(s) as well as to the institution(s) where he has worked or is currently working, since his affidavit has nothing to do with all those, as conceded by affiant in the footnote [1] of his affidavit.

3. Based on my considerable education and experience in electromagnetics and propagation phenomenon, I believe myself to be an expert in the technological area of U.S. Patent Application Serial No. 09/786, 507, entitled: "Apparatus For Generating Focused Electromagnetic Radiation" (the '507 application).

4. I have reviewed the '507 application as originally filed, (attached as Exhibit A), the Examiner's Official Action dated December 15, 2003, (attached as Exhibit B), a document entitled "Description of an Experiment: Response to the First Office Action by the U.S. Patent Office on the Application No. 09/786,507," (attached as Exhibit C), and a document entitled "Description of Some Experimental Results: Response to the First Office Action by the U.S. Patent Office on the Application No. 09/786,507," (attached as Exhibit D).

Examiner's Response to (3) & (4): No comment.

5. *The '507 application claim 21 recites an apparatus for generating electromagnetic radiation that includes polarizable or magnetization medium and a means for generating in a controlled manner a polarization or magnetization current or charge distribution. The current distribution has an accelerated motion with a superluminal speed and generates non-spherically decaying electromagnetic radiation whose intensity falls off at a rate at or about 1/R in the far field. R is the distance from the current distribution. This fall-off rate or attenuation is considerably less than the rate at which the intensity of electromagnetic radiation normally falls off, i.e., IIRR .*

6. The invention described in the '507 application has an extremely wide range of applications. Some examples include high bandwidth telecommunications, secure communications, hand-held communication devices, compact sources of intense broad band radiation, medical diagnoses and

treatments, and biomedical research. Of course, there are many other applications. The Examiner contends that the principles described and claimed in the '507 application violate the special theory of relativity. The claimed invention does not violate relativity principles because the electromagnetic radiation itself is not described or claimed to be traveling at greater than the speed of light. Rather, it is the current distribution, which is the source of the EM radiation that can achieve superluminal speed. An example of a phenomenon that travels at a speed greater than light is a pair of scissors whose tips are moving just below the speed of light. In this situation, the intersection of the blades moves at a speed faster than the speed of light.

Examiner's Response to (5) & (6):

This is one of the issues where the affidavit has missed the point. The examiner specifically "*contends that the principles described and claimed in the '507 application violate the special theory of relativity*" with regard to a majority of statements in the disclosure as identified in paragraph 5, item (a) to (d) of the office action, i.e., the statements on (a) page 4, paragraph 2, line 2; (b) page 6, paragraph 1, lines 1-2; (c) page 7, paragraph 3, line 1; (d) page 27, paragraph 3, lines 7-8; and some other not yet identified/specified statements recited in the disclosure, e.g., on pg.4/line 8, reciting a "superluminally rotating source". Those statements remain strongly objected for violating the special relativity theory, which states that no material object, including radiation source such as real current, or polarization current (displacement current), can move faster than light velocity in vacuum, c. However, the examiner does not object other correctly formulated statements such as on page 2, paragraph 2, line 1, "The speed of the moving distribution pattern may be superluminal"; and again on page 3, paragraph 3, lines 4-5, reciting "whose distribution patterns propagate with a phase speed exceeding the speed of light in vacuo", since a pattern is not a material object, and hence, may well achieve, or even exceed, the speed of light in vacuo, c. However, these statements have been effectively overridden by more frequently recited

contradicting statements claiming on superluminal velocities of material objects throughout the entire disclosure", e.g., on pg.4/line 8, reciting a *"superluminally* ***rotating*** ***source"***; and just recently, in Exhibit D, in reference to Fig.1(e) on page 3, reciting that the array curvature "*introduces centripetal acceleration in the moving polarized region*". While the movement (***V***) itself is already an imagination which does not really exist (and hence, is never used in the art jargon), its mathematical derivative, i.e., acceleration = d***V***/dt, is a "second order" imagination that is even further remote from any physical reality and relevance. It would be even more incredible to one of ordinary skill in the art if such a "second order" imagination would ever manage to cause a real effect.

It is to be noted that a distribution pattern moving with "superluminal" velocity is not new at all, but has been routinely utilized since many decades for the conventional phased antenna array and optical beam steering in optical communications. The same effect is also used for beam steering/focusing in the medical ultrasound technology.

7. The Examiner contends that the principles described and claimed in the '507 application violate the special theory relativity. The claimed invention does not violate relativity principles because the electromagnetic radiation itself is not described or claimed to be traveling at greater than the speed of light. Rather, it is the current distribution, which is the source of the EM radiation that can achieve superluminal speed. An example of a phenomenon that travels at a speed greater than light is a pair of scissors whose tips are moving just below the speed of light. In this simulation, the intersection of the blades moves at a speed faster than the speed of light.

Examiner's Response to (7):

It is noted that Affiant is arguing along the same line with the examiner. The examiner never contends that applicant's electromagnetic radiation is traveling faster than light. However, as already explained many times in various paragraphs of this office action as well as in the previous one, the ambiguous wording *"current or charge*

distribution" has been frequently (mis)construed by applicant as being a truly material object, e.g., on pg.4/line 8, reciting a *"superluminally rotating source".* What applicant really means with moving at "superluminal" velocity is no other than merely the **phase** _of this distribution_ (see also Hewish'2000), but not the source itself, since the latter would inevitably violate the known law(s) of nature.

Affiant's example of a scissor is well known in the art since many decades. Affiant would certainly agree with the examiner, that, the "*intersection of the scissors' blades*" that "*moves with superluminal speed*", while being merely some kind of "*pattern*", i.e., an abstract idea/concept as opposed to real/material object, will never cause Cerenkov radiation, or any kind of radiation, whatsoever. In this regard affiant's example is not rebutting, but supporting the examiner's standpoint, thus justifying the examiner's suggestion to eliminate every recitation of "superluminal" from the disclosure, since --as admitted by the affidavit-- _there is in fact no superluminal movement (of material object) at all._

8. Regarding the non-spherical decay recited in claim 21, it can be demonstrated using Huygens wavelets that there are locations where multiple waves from [of] the source of radiation (or current or charge distribution) can simultaneously arrive at a point in space, labeled a "cusp" in the '507 application, which create a higher than usual intensity due to constructive interference. Moving away from the distribution, more wavelets converges on the cusp, giving rise to nonspherical decay in the far field better than $1/R^2$. Because there is constructive interference at these cusp points and destructive interference elsewhere, the amount of energy passing through any given spherical surface surrounding the current or charge distribution is constant. Thus, conservation of energy is not violated.

Examiner's Response to (8):

The definition of the cusp itself and the derivation of its locus in the disclosure are plagued with inconsistencies, not only within the disclosure itself (see sub-paragraph

43(a.3-4), but also with the experimental data (see sub-paragraph 43(e)). This indicates a conceptual error, which might well arise due to the multi-valued variable and parameters thereby involved, and/or a dimensional defect in the analysis (such as regarding the variable $\varphi^{\wedge}$). Therefore, the suggestion to provide hard evidence in the form of antenna gain is here appropriate.

The examiner disagrees with the affiant's position regarding the violation of energy conservation law. The examiner's standpoint is mathematically demonstrated in paragraph 43(j) in reference to Eq.7. If the total energy (or power) passing through the entire beam cross section at, or beginning with a certain R overgrows the energy/power input at the source, the energy conservation law is obviously violated. This applies irrespective thereof, whether or not the cusp is interpreted as being a focal point into which converging wavefront envelopes meet together, or something else.

Independent from the energy conservation law violation, the same non-spherically decaying behavior is also shared by most focused beams, including a conventionally focused laser beam, as rigorously described by the examiner in sub-paragraph 43(j), so that it is unpersuasive to claim the measured radiation property as being unique only to applicant's "cusp". Furthermore, the majority of the claims do not specifically recite any focusing effect, rendering affiant's explanation confusing, for being different than applicant's claimed invention. In short, if the non-spherically decaying behavior is caused by focusing effect, there is no invention to be claimed in this application, since everything is conventional.

9. The examiner improperly characterizes the invention nothing more than laser beaming or a phased array antenna. The intensity of laser radiation diminishes with the distance R from its source like $1/R^2$ in the far field, where R is greater than the Fresnel distance. Thus, laser radiation decays spherically rather than non-spherically. Moreover, the claimed apparatus is not just another phased array antenna because it generates an intense energy cusp as described in the specification and illustrated in Figures 3, 4, and 9.

Examiner's Response to (9):

The affiant improperly characterizes the invention as distinctively different than conventional beam forming and steering by a phased array. The invention is no other than beam forming & steering by a phased array. The lengthy discussion in sub-paragraph 6, evidenced by *prima facie showing* supported by a large number of prior art references and scientific publications, proves the correctness of the examiner's interpretation of applicant's invention. This also includes the non-spherically decaying property of a collimated and/or focused laser beam, thus refuting every aspect of affiant's argument. The fact that laser radiation in the far field also decays spherically is already well known to those skilled in the art, but that is only true if the distance is measured from the beam waist (see Melles-Griot "Laser Beam Measurement", available at http://beammeasurement.mellesgriot.com/tut_gaussian_beam_prop.asp>, hereinafter [Melles'Griot]; or Souw, "Handbook of Optical Deep Space Communication Technology", hereinafter [Souw'Handbook]). If the distance is measured from the collimating optics, the intensity decay behavior is non-spherical ($\sim 1/r^x$ with $x<2$) up to (many) multiples of the Rayleigh range. This fact is well-known even to those only minimally skilled in the art, such as Physics undergraduates, and can be easily demonstrated by substituting the distance variable z in the conventional formula for Gaussian beams (which is conventionally measured from the beam waist) by a distance

z' measured from the collimating optics z'=z+f, with f being the focal length of the collimating optics, resulting in a decay behavior that has a non-spherical component $1/r^x$. The non-spherical behavior can also be seen by plotting the intensity ratio as a function of this new distance variable z', i.e., $I(z')/I_0(z') = I(z')/(1/z'^2)$.

10. After reviewing the experiment described in Exhibit C, I have determined that the instrumentation was properly configured and the testing conducted in accordance with standard scientific procedures. I have reviewed the experimental test results as set forth in Exhibit D and have determined that the data interpretation was correct. Specifically, appropriate consideration was given to common mode rejection from transmission lines and to ground reflections.

Examiner's Response to (10):

As described above in the examiner's evaluation section, the experiment does not simulate a true Cerenkov effect, because the array keeps radiating even if the phase velocity is "subluminal". It is the dipole oscillation of the dielectric antenna excited (not "modulated") by 552.7 MHz which is generating the radiation, irrespective of the imaginative "phase velocity". Even if the dipole distribution is homogeneous, such that no "phase velocity" can be attributed to the dipole distribution (without modulation), the array will keep radiating. Further, if the oscillation of the array elements is given the appropriate phase shift, a beam forming and beam steering will result. Therefore, the purpose the 46 MHz modulation is totally obscure (allegedly to simulate some kind of "distribution"), so is also the role of the 10^0 arc supposedly to simulate a centripetal acceleration in a rotating star. Essential is only the role of the time delay Δt=140 ps in making the imagined phase velocity "superluminal". However, this Δt is no other than

the same time delay to induce a phase shift $\Delta\Phi$ between successive array elements (separated by d) in a conventional phased array antenna so as to form a directional beam by interference and scan the direction the beam into an angle θ according to the relation $\Delta\Phi=(2\pi d/\lambda)\cdot\cos\theta$ (Eq.1a), which can be easily worked out to derive the necessary time delay, $\Delta t=d\cdot\cos\theta/c$ (Eq.1d), to associate with an imaginative "phase velocity" of $V_d=d/\Delta t=c/\cos\theta$ (Eq.1b), the latter having to be made always greater than c in order to establish beam forming/steering. Obviously, applicant's "superluminal" velocity is no other than the inherent condition of beam steering for a conventional straight linear array. No array curvature (to simulate a centripetal acceleration as in a rotating star) and no modulation (to simulate a displacement current "distribution") are here needed.

Thus, the experiment is nothing else than a phased array antenna operating in a beam-steering mode, which has been known in the art since a few decades. The applicant and his research group is herewith challenged by the examiner to rebut the examiner's evaluation, that applicant's condition for Δt and V_d is no other than conventional beam steering condition, and the result of the measurement is nothing else than the conventional result of exciting a conventional array by a DSB/SC modulation technique very well known in radio transmission, i.e., in complete absence of the expected radiation spectrum at higher frequencies (except, of course, the higher harmonics as conventionally known from RF modulation technique).

Giving consideration to common mode rejection from transmission lines and to ground reflections belongs to routine technical/lab procedures, and has nothing to do

with correct scientific analysis and/or deduction. Regarding the latter, too many flaws are thereby involved, e.g., inconsistencies between the experimental geometry and the disclosure, and the measured ratio $P_{cusp}/P_{sub} < 1$ shown in Fig.11 Exhibit D, all of which only justify the examiner's conclusion that the measured radiation (P_{cusp}) is less efficient than a normal spherical decay (P_{sub}). Furthermore, extrapolating the trend of an experimental curve made up of many hundreds of widely scattered data points based on one single data point that is an exemption among the others, as has been made in Fig.11(a), is not within skill in the art.

11. Figure 1 in Exhibit D illustrates the intensity versus distance on a log scale for radiation generated by a subluminal (slower than speed of light) current distribution. Figure 2 Exhibit D illustrates the radiation intensity versus distance generated by a charge or current distribution having superluminal speed. Figure 3 Exhibit D illustrates the ratio of the radiation intensity at superluminal speed over the radiation intensity at subluminal speed. The radiation intensity in Fig. 1 decays at a rate of approximately 1/R once account is taken of interference from the ground, while the slope of a line corresponding to that ratio confirms that the intensity in Figure 2 decays at a rate of approximately 1/R, where R is the distance from the charge or current distribution.

Examiner's Response to (11):

From the conventional beam steering theory (see Fig.1A) it is known that under imaginative "subluminal" conditions of $V_d<c$ the radiation is distributed over 4π steradians, i.e., spherical, whereas under imaginative "superluminal" condition of V_d the radiation is directional (beam steering mode). As discussed in sub-paragraph 43(j), the experimental results shown in Figs.11(a) to (d) does not show what is claimed by the invention. The "cusp" power is evidently (much) less than the "subluminal", i.e., spherical decay case. The apparent 1/R decay rate is thereby irrelevant, especially if the power is smaller than a $1/R^2$ decaying radiation. Such behavior is also inherent to

many other conventional radiation within the near field zone (see previous example of laser beam).

Communications

45. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard E Souw whose telephone number is 571 272 2482. The examiner can normally be reached on Monday thru Friday, 9:00 am to 5:00 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R Lee can be reached on 571 272 2477. The central fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306 for regular communications as well as for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

bes
November 19, 2004

JOHN R. LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

APPENDIX

Figure Drawings

Figs. 1 –6

Fig. 1A

Phased Array under "subluminal" condition

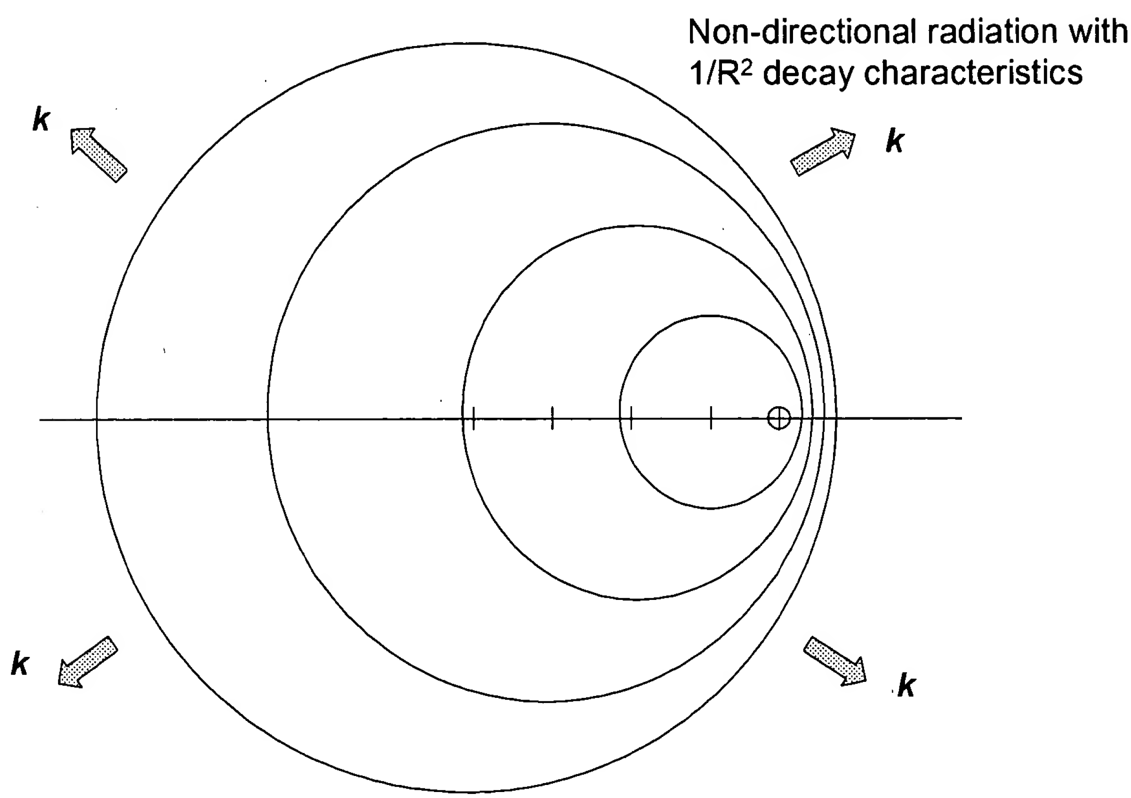


Fig. 1B

Phased Array under "superluminal" condition

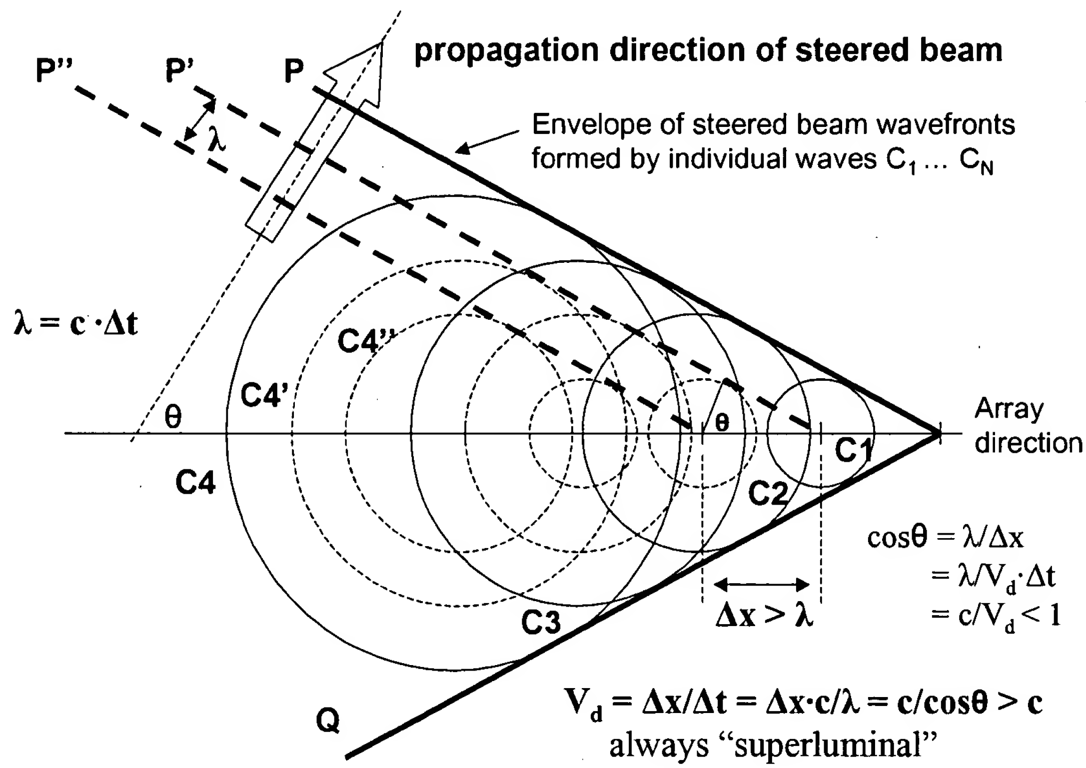


Fig. 2

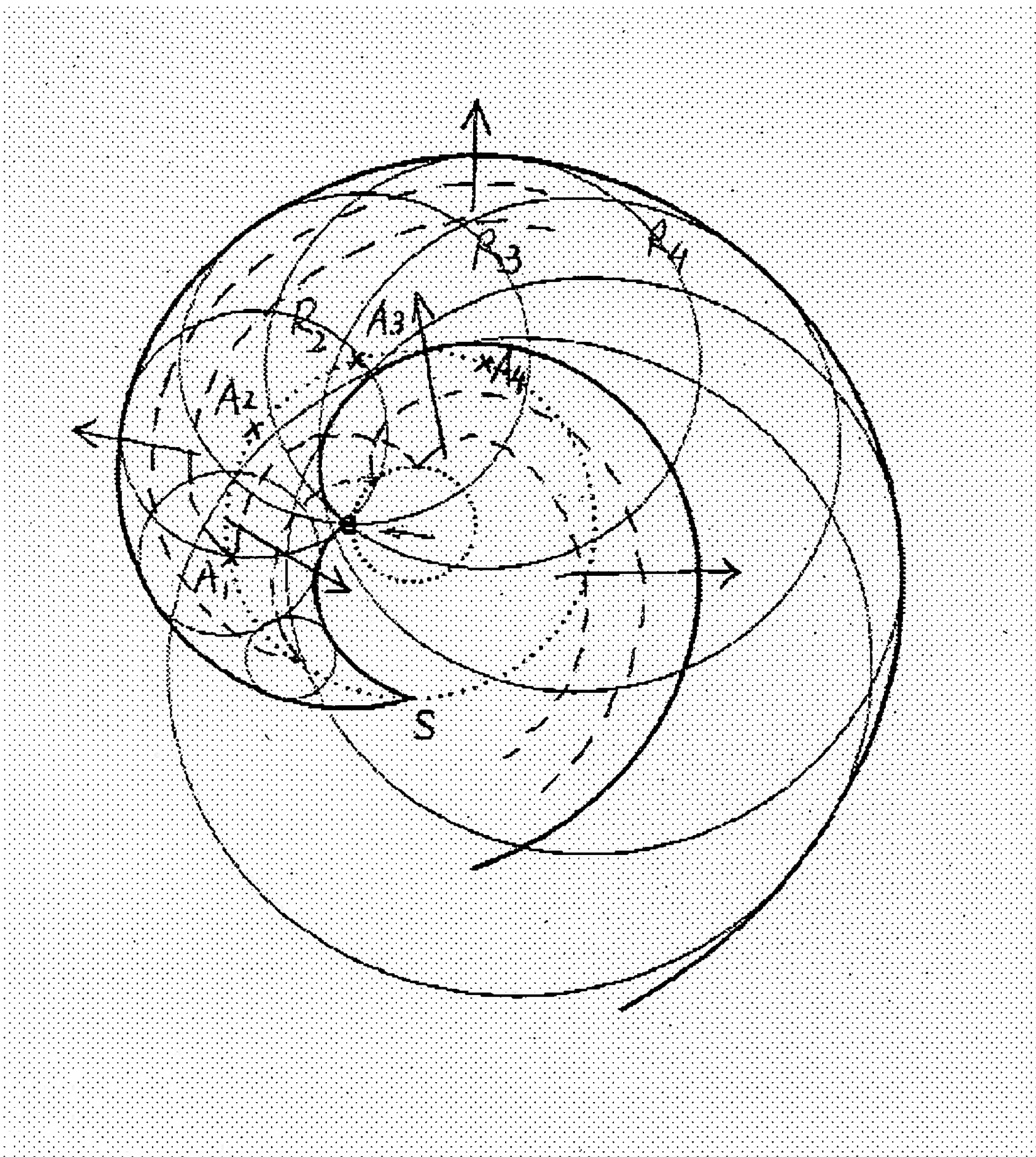


Fig. 3

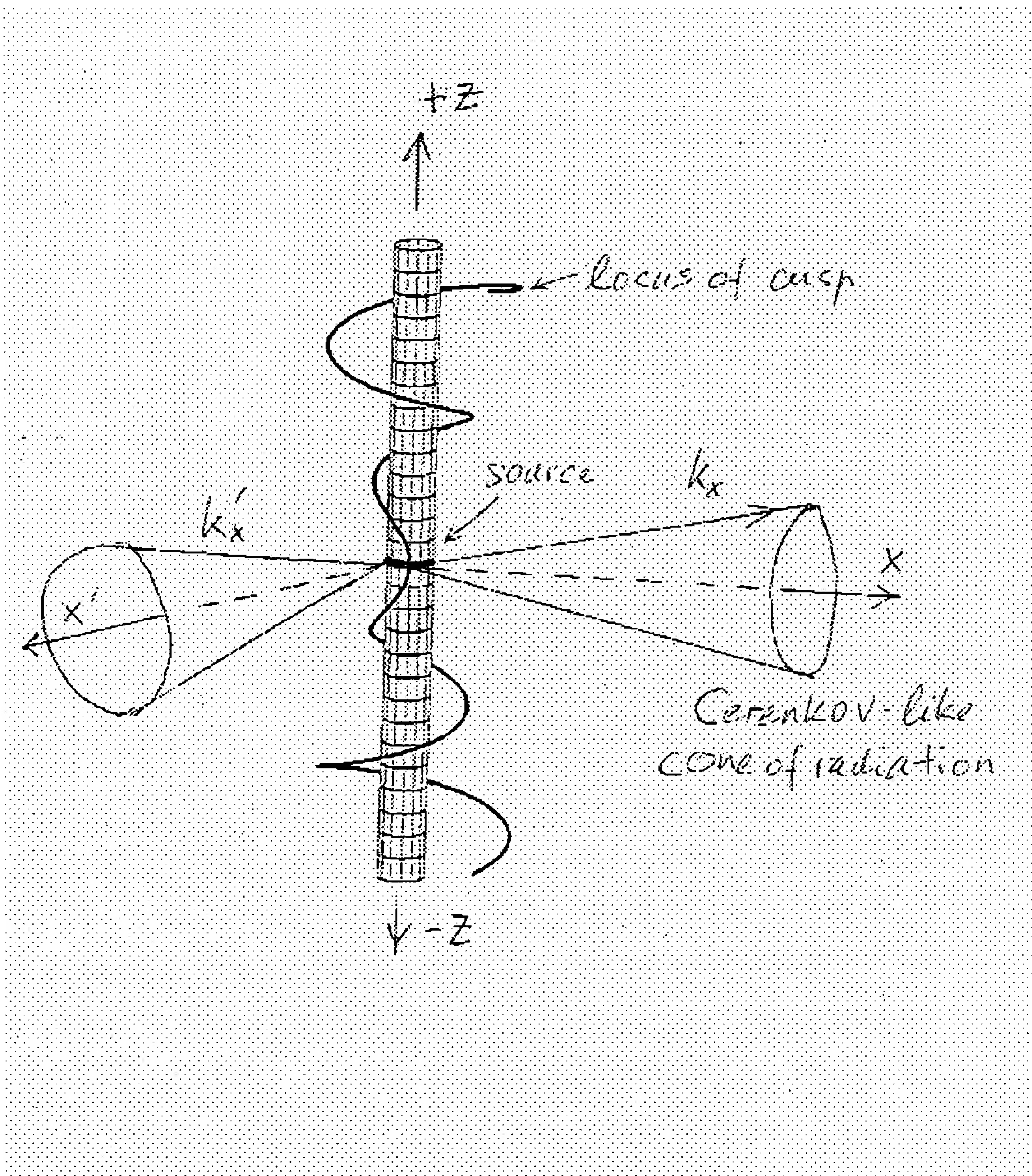
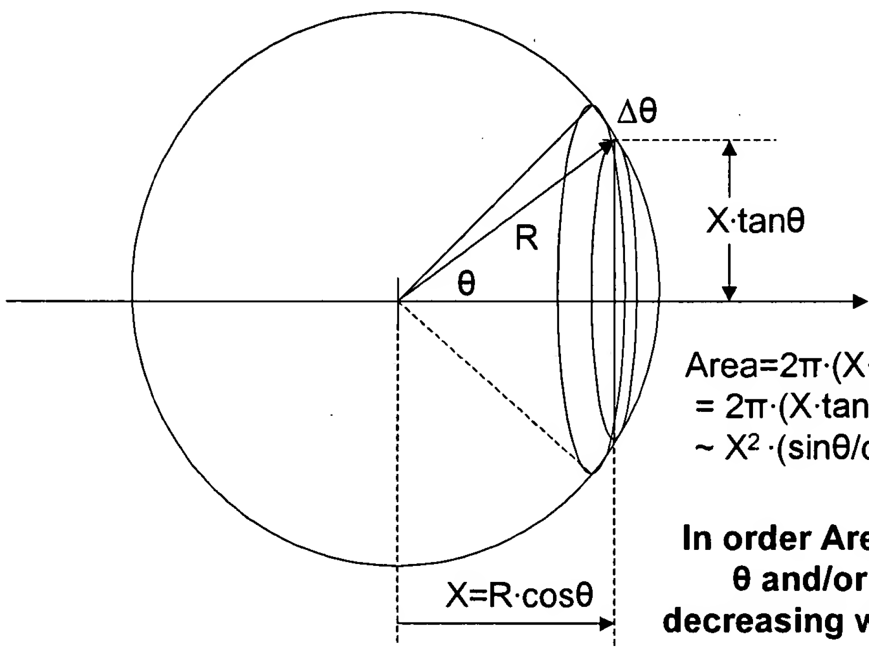

+Z
locus of cusp
source
k_x
k_x'
x
x'
-Z
Cerenkov-like
cone of radiation

Fig. 4

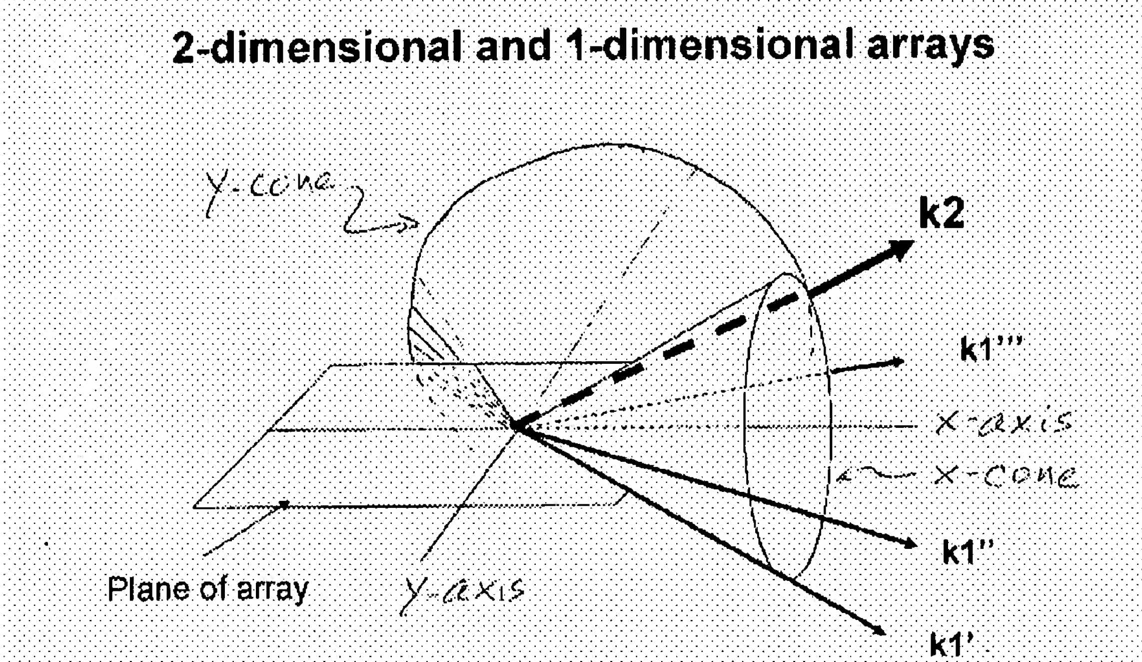
Effect of smearing out φ^ on spherical decay behavior



$$\text{Area} = 2\pi \cdot (X \cdot \tan\theta) \cdot R\Delta\theta$$
$$= 2\pi \cdot (X \cdot \tan\theta) \cdot (X/\cos\theta) \cdot \Delta\theta$$
$$\sim X^2 \cdot (\sin\theta/\cos^2\theta) \cdot \Delta\theta$$

In order Area ~ X^n with $n<2$ θ and/or Δθ must be decreasing with increasing X

Fig. 5A



k1' .... k1''' on Cerenkov-like cone of 1-dim. array
k2 = intersection of 2 Cerenkov-like cones 2-dim. array

Fig. 5B

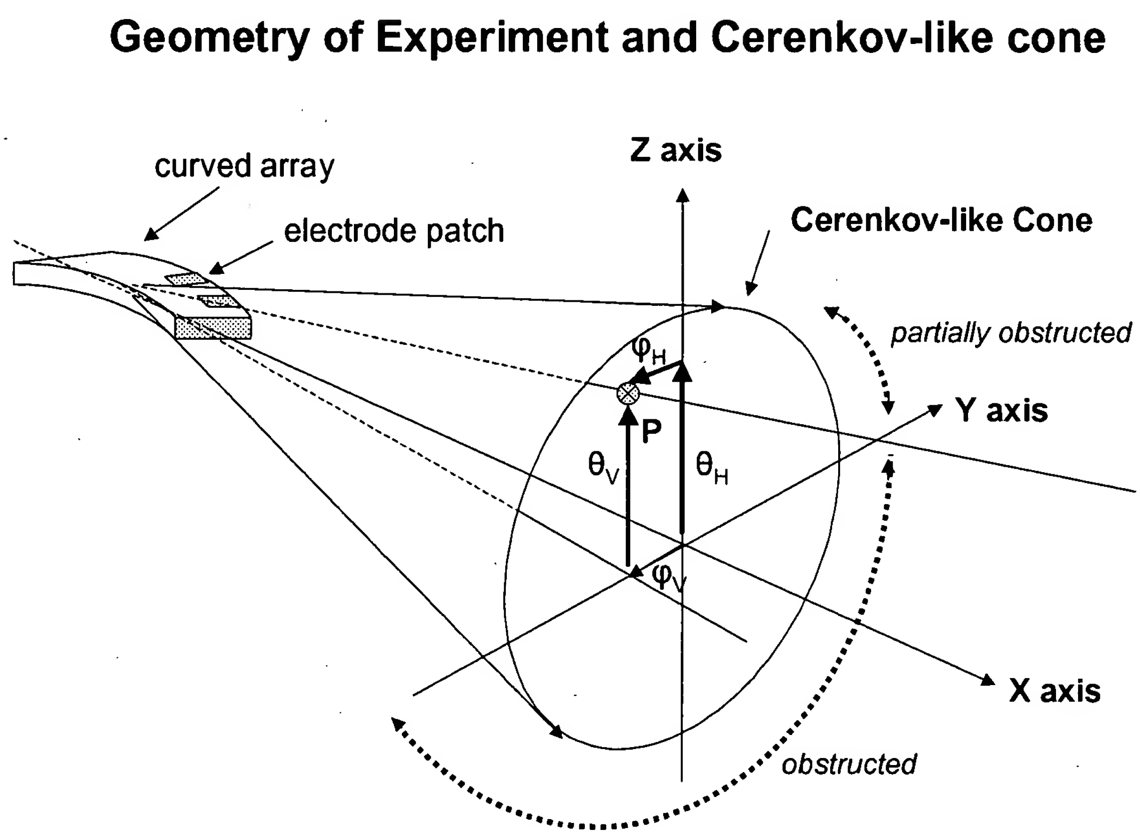
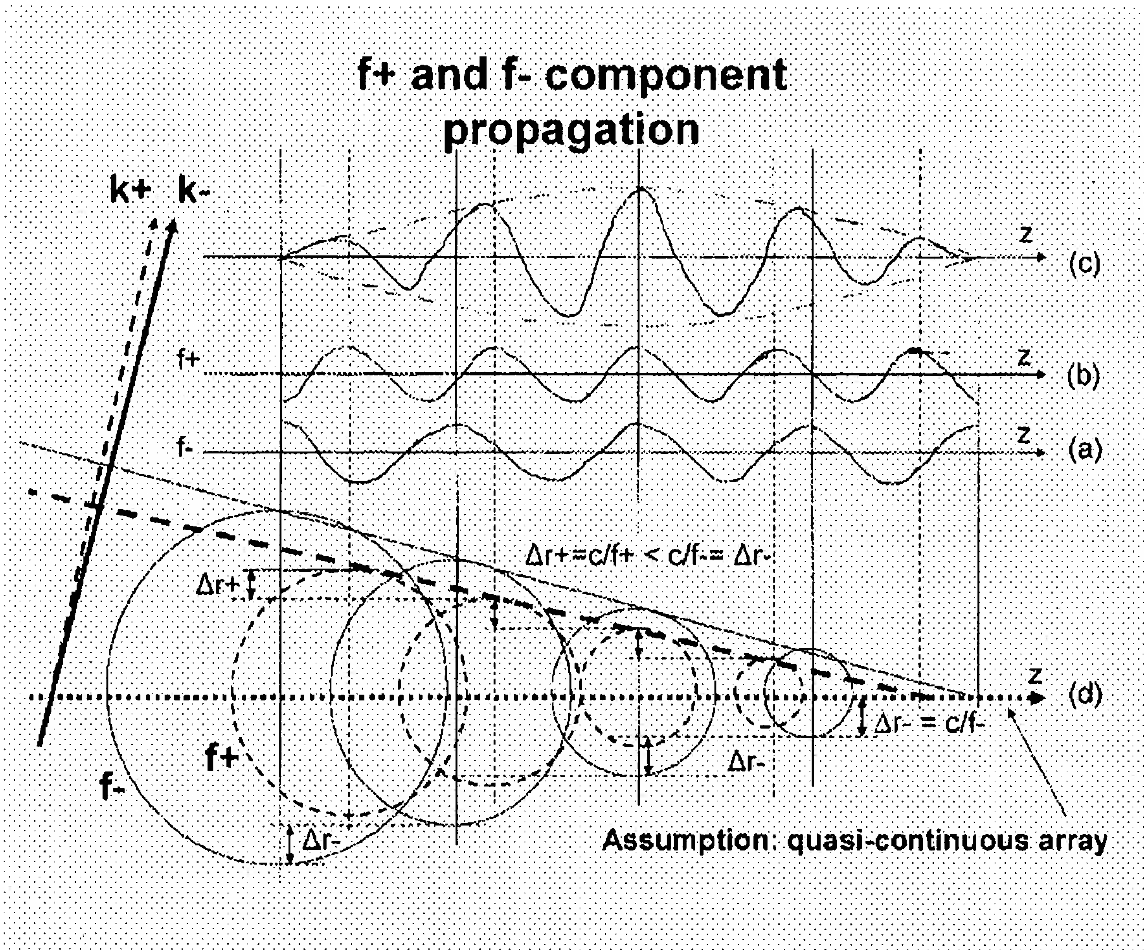

Geometry of Experiment and Cerenkov-like cone
curved array
electrode patch
Z axis
Cerenkov-like Cone
partially obstructed
φH
Y axis
P
θV
θH
φV
X axis
obstructed

Fig. 6


f+ and f- component
propagation
k+ k-
z
(c)
f+
z
(b)
f-
z
(a)
Δr+=c/f+ < c/f-= Δr-
Δr+
z
(d)
Δr- = c/f-
f+
Δr-
f-
Δr-
Assumption: quasi-continuous array